The business model cycle:
A dynamic and user-centric perspective
on business model design and change
with a case study from the mobility sector

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Executive summary

Today, firms all over the world have to deal with dynamic business environments. Static business models are no longer valid, and lose impact faster than changes can be implemented to address the problem. Fast-moving digitalization has made information more transparent, strengthening the role of the customer. At the same time, the provider can have a much closer relationship with the user, thanks to real-time communication. To meet changing user needs and to stay competitive over time, businesses are being forced to adopt a dynamic and user-centric business model perspective. However, corporate practice does not have a process for developing dynamic business models, and user-centric business models that can be designed and changed using smart technologies have not yet been systematically integrated. To stay competitive, companies need to rise to this challenge. But how?

The aim of this dissertation was to develop a dynamic, user-centric process model for business model design and change, and to evaluate the model's ability to maintain a competitive advantage in the mobility sector. First, the differences between static, dynamic, and user-centric business models and their corresponding attributes were deduced. Then, these findings were combined into a process model using system dynamics logic. This model considers the user a co-creator of value and helps managers react to real-time changes in their business model environment. Finally, a mobility sector case study is presented to highlight the relevance of this model to real-world application.

These findings were used to develop the business model cycle (BMC). In this dissertation, the phases, underlying components, activities, and connecting input and output streams of this process model are described. The BMC consists of two interlocked loops – the user phase and the provider phase – which continuously send feedback to one another. A touch point was included between the loops so that firms can observe the user in their environments and adapt their business model simultaneously according to changes in their users' needs. This meta process model configuration makes a significant contribution to the theory of business model dynamics and customer centricity.

The BMC supports the strategic management of dynamic, user-centric business model design and change activities. It describes a step by step procedure of business model design that includes ideation, prototyping, and integration of business model options.

Moreover, it allows continuous monitoring of the business model environment and adaption of the model accordingly. At the same time, bidirectional interaction between the user and provider is possible, allowing the provider to adapt to their users' needs. The BMC is unique in that these processes can take place simultaneously.

The real-world case study in the mobility sector confirmed that using the BMC for strategic management maintains a lasting competitive business advantage. Taken together, these findings show that a dynamic, user-centric process for business model design and change sustains dynamic consistency between the business model's core elements. This indicates that the internal configurational fit of the business model is in line with its external dynamics.

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List of abbreviations

3Vs	volume, variety, and velocity
AI	artificial intelligence
AmI	ambient intelligence
AR	augmented reality
B2B	business-to-business
B2C	business-to-consumer
BMC	business model cycle
BPMN	Business Process Model and Notation
CRM	customer relationship management
e.g.	exempli gratia, for example
i.a.	inter alia, among other things
i.e.	id est, that is
IoT	internet of things
IT	information technology
Mobile app	mobile application (e.g. for smartphones)
NFC	near field communication
PMR	indicator of product market regulation
PoS	point of sale
PoU	point of use
PSS	product service system
RFID	radio-frequency identification
s. str.	sensu strictu (in the narrower sense)
SaaS	software as a service
SDLC	software development life cycle

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List of symbols

$\emptyset$	A set with no elements
C	The number of components
c_{BM}	The business model component
c_{PoU}	The point of use component
c_U	The user component
c_{VCD}	The value creation and distribution component
c_{VP}	The value proposition component
D	Density
IC	The number of interlocked components
ic_T	The touch point between phases
ic_{VD}	The interlocked value development component
K	The number of interlocked phases
K_{max}	The maximum number of interlocked phases
P	The number of phases
p_{Pr}	The provider phase
p_U	The user phase

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1 Introduction

1.1 The relevance of dynamic, user-centric business model design and change

Today, enterprises operate their business models in **ever-changing dynamic environments**. They face intense competition and increasing globalization. Within the first quarter of 2019, 256,000 companies started business in the United States alone.[1] The global export volume multiplied by a factor of 300 from 1950 to 2018.[2] Shorter innovation cycles and deregulation make this environment even more dynamic. The number of worldwide patent applications has increased steadily over the years, reaching 3.32 million patents in 2018.[3] Market regulations have decreased worldwide, dropping by 42% in Germany within a 15-year period.[4]

"Not only do established firms frequently fail to embrace opportunities through digitization and big data analytics, they also struggle to adapt their business models to reflect the associated economic features and underlying mechanisms."[5]

Digitalization accelerates these developments and companies have begun to embrace the full spectrum of technological opportunities.[6] Enabling innovation, improving customer experience, and running artificial intelligence applications are the top three drivers of IT transformation.[7] Companies are investing more than ever in technologies that enhance their digital evolution, and the worldwide market revenue is expected to double to 2.3 trillion U.S. dollars between 2019 and 2023.[8] Cloud computing, Internet of Things,

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1 Refer to Bureau of Labor Statistics 2019.

2 Refer to UNCTAD 2019.

3 Refer to WIPO 2019.

4 Indicator of product market regulation (PMR) in Germany in 1998 compared with 2013. The PMR includes state control of business enterprises, legal and administrative barriers to entrepreneurship, and barriers to international trade and investment. Refer to OECD.

5 Loebbecke and Picot 2015, 151.

6 Within the scope of this dissertation, *digitalization* is chosen over *digitization.* The latter means the conversion of analog material into a digital, i.e. numerical format. Digitalization, on the other hand, "[…] means that business now uses technology to engage with people to precisely address their particular needs." Prause 2016.

7 Refer to Datrium 2019

8 Refer to IDC and Statista estimates 2019.

artificial intelligence and machine learning, and big data (analytics) are expected to have the greatest impact on analytic initiatives over the next five years.[9]

"Your customers are the judge, jury, and executioner of your value proposition. They will be merciless if you don't find fit!"[10]

Digital transformation also strengthens the **role of the customer** thanks to effortless access to information, alternatives, communication, and transactions. In 2018, the estimated global online access rate was 51.2%. Worldwide mobile data traffic has a compound annual growth rate of 46%.[11] In 2018, 52.2% of all website traffic was generated through mobile phones.[12] These mobile technologies allow consumers to immerse themselves in a hybrid space with ubiquitous connections to others, with no distinction between online and offline realities. These days, companies meet users in their hybrid spaces, at their points of use.[13] Digital interaction allows providers to gain insight into their customers' journey. Users become active participants in open innovation processes, and new sources of user data and techniques for real-time data processing facilitate user-centric design and change processes.[14] Digitalization not only enables user centricity but also forces companies to adopt user-centric business models and value propositions to be successful.[15]

"[…] far from being static, business models need to be in a continuous flux, responding to opportunities and threats in the firm's external environment."[16]

A firm must assess the opportunities and threats from its external environment and fit with its internal environment to be competitive in the long run.[17] In a constant state of disequilibrium, the business model strives for **dynamic consistency** because it stays between the external and internal fit. Managers must overcome the static perspective of business models and acquire dynamic capabilities to implement a constant process of

[9] Refer to Forbes and MicroStrategy 2019.
[10] Osterwalder et al. 2014, 43.
[11] Refer to Cisco Systems 2018; ITU 2018.
[12] Refer to We are Social and StatCounter 2018.
[13] Refer to Šimůnková 2019, 41–67.
[14] Refer to Gerdes 2018, 190–194; Pinkwart 2018, 359.
[15] Refer to Osterwalder et al. 2014, 42–44; Kalka and Abel 2018, 6.
[16] Saebi 2015, 145.
[17] Refer to Pfau 2001, 5.

business model design and change.[18] A user-centric business model must create value that produces customized solutions rather than single products and services.[19] Here, the user is the driver and co-creator of business model design and change.[20] Both strategic management and marketing professionals need processes and tools for the dynamic, user-centric design and change of business models and their underlying value propositions.[21]

“Transportation is the center of the world! It is the glue of our daily lives. When it goes well, we don’t see it. When it goes wrong, it negatively colors our day, makes us feel angry and impotent, curtails our possibilities.”[22]

The **mobility sector** is an example of a rapidly changing market. The automotive industry in particular faces challenges because nine European countries are currently discussing banning internal combustion engines by 2030, and CO_2 penalty payments to the European Union are imminent. This could cost the automotive industry up to 15 billion euros by 2021 if they do not expand their product portfolio with more electric vehicles.[23]

Traditionally segmented industries or modes of transport, such as rail, public transport, car, bike, or aviation are converging into a new market where mobility is a service. Numerous competitors from other sectors and new mobility business models have entered this market in the last decade. A market volume between 2.2 and 2.5 trillion U.S. dollars is estimated in mobility businesses by 2030.[24] With increasing population growth in urban areas, the worldwide mobility demand is expected to rise by 88% to 48.4 trillion passenger kilometers from 2010 to 2030.[25]

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18 Refer to Demil and Lecocq 2010, 239; Amit and Zott 2015, 11–15.

19 Refer to Vandermerwe and Rada 1988, 315–317; Sawhney 2006, 8; Pawar et al. 2009, 474–475.

20 Refer to Norman and Ramirez 1993, 66; Vargo and Lusch 2004, 7–12; Lamberti 2013.

21 Refer to Demil and Lecocq 2010, 239–244; Daecke and zu Knyphausen-Aufseß 2011, 143–162; Evanschitzky et al. 2011, 659; Frankenberger et al. 2013a, 265–268; Loebbecke and Picot 2015, 149–155; Bruhn 2018, 37–39.

22 Robin Chase, co-founder of Zipcar. Refer to Schawbel 2012.

23 Refer to Tschiesner et al. 2019, 9

24 Refer to BI Intelligence and Business Insider 2018; Tschiesner et al. 2019, 9. Data from BI Intelligence and Business Insider consider mobility services that represent non-personally owned modes of transportation that are consumed as a service, such as car-sharing.

25 Refer to Wagner 2019, 20.

Mobility providers offer access to – but do not necessarily own – shared fleets of public buses, cars, bicycles, or electric scooters. Digitalization and mobile technologies have paved the way for on-demand mobility that integrates long-established (e.g. public transport) and new (e.g. ridepooling[26]) mobility services into one digital offering. Digital transformation has strongly shaped the mobility sector; over the last five years, the average yearly investments were 20.9 billion U.S. dollars for software-based and 18.7 billion U.S. dollars for hardware-centered mobility start-ups worldwide.[27]

Shifting user demands also drive market change. Users are seeking more individuality and independence, and choose from diverse transportation modes to handle the growing complexity of their daily lives. The most flexible means of transportation – the car – has gained from this development. But multimodal travel and intermodal trip-making has also gained users.[28] The more means of transportation are used within a weekly mobility routine, the less kilometers are travelled by car.[29] Mobility providers face a heterogeneous market that is highly competitive and dynamic, driven by digitalization, user demands, and environmental regulations. Here, processes for dynamic, user-centric business model design and change are urgently needed.

1.2 Research gap and objective

Dynamic, user-centric business model design and change are relevant to the complex and fast-moving nature of markets and industry landscapes. Progressive digitalization and users that choose a hybrid space with no distinction between being online and offline have made dynamic, user-centric business model design and change not only possible but also inevitable for companies that want to be competitive.[30]

In **corporate practice**, the processual observation of business models and their design, management, and change over time has not been integrated systematically.[31] Although it is not clear how many companies already use a systematic process model, certain enterprises have successfully managed user-centric and dynamic business model de-

[26] Ridepooling "[…] involves sharing a ride at a reduced fare with someone else taking a similar route […]". Shaheen and Cohen 2019, 431.

[27] Refer to McKinsey et al. 2019.

[28] Refer to Klinger 2017, 221–225.

[29] Refer to Nobis and Kuhnimhof 2018, 59.

[30] See previous chapter.

[31] Refer to Demil and Lecocq 2010, 227–230; Sosna et al. 2010, 383–384; Hienerth et al. 2011, 346; Priem et al. 2018, 25–26.

sign and change in the long run. For example, *Netflix* have assessed and redefined their business model multiple times using data analytics. The company started by renting out DVDs via mail. Based on customer orders, *Netflix* sent the ordered DVDs and recommended new ones. This early use of data analytics improved demand management and distribution of the product, and improved the relationship between provider and user via recommendations. At that time, *Netflix* was not able to monitor when their customers watched the ordered DVDs and the actual value in use was unfolding. With the evolution of information technology, the company changed and redesigned its business model to provide unlimited video streaming as a subscription service. With this business model, *Netflix* can gather and process real-time or context-user data (e.g. search terms, stream queues and plays, ratings, ratings from friends, interactions, external sources such as film reviews, and social data). Additionally, *Netflix* can intervene in use processes wherever their customers are using the service (which could be anywhere from their living room to a public train). Big data analytics have allowed *Netflix* to personalize content and recommendations, and to adapt sequels of their shows to their users' preferences and needs. This has changed the value proposition and probably value creation component of their business model, because *Netflix* eventually started producing their own content.[32]

Companies that dynamically design and change their user-centric business model with fast-evolving, smart technologies and techniques are outnumbered by companies with traditional, static business models.[33] This pool of practiced business models gets even smaller when customers can co-create value, which is one of the requirements of user centricity.[34]

This user-centric and dynamic perspective of business model design and change, regardless of whether smart technologies are applied or not, represents a **research gap in management and marketing literature**.[35] The published literature and concepts

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[32] For this paragraph, refer to Lycett 2013, 382–383; Günther et al. 2017, 198–201

[33] For further examples, such as New York Times (big data analytics) refer to Günther et al. 2017, 198, 7-eleven Japan (big data analytics) refer to Woerner and Wixom 2015, 61, smart shoe technology in health-care (Internet of Things) refer to Eskofier et al. 2017, elevator industry (Internet of Things), refer to Lai et al. 2017. See also chapter 5.3.4.1 for more examples.

[34] Refer to Hienerth et al. 2011, 346. Customer co-creation is one of the requirements of user centricity, see chapter 2.3.

[35] Refer to Demil and Lecocq 2010, 239–244; Sosna et al. 2010, 385; Daecke and zu Knyphausen-Aufseß 2011, 143–162; Evanschitzky et al. 2011, 659; Hienerth et al. 2011, 344–348; Frankenberger et al. 2013a, 250–253; Loebbecke and Picot 2015, 151–155; Mathis and Köbler 2016, 460; Bruhn 2018, 37–39.

discussed herein do not include business model design and change, applied attributes (dynamic, user-centric), or thorough theoretical grounding.[36] Most of the works examined here discuss static frameworks instead of processual models that reflect the logic of dynamic approaches.[37] Wirtz et al. found that relevant future research into business model processes should focus on change, evolution, innovation, and design.[38]

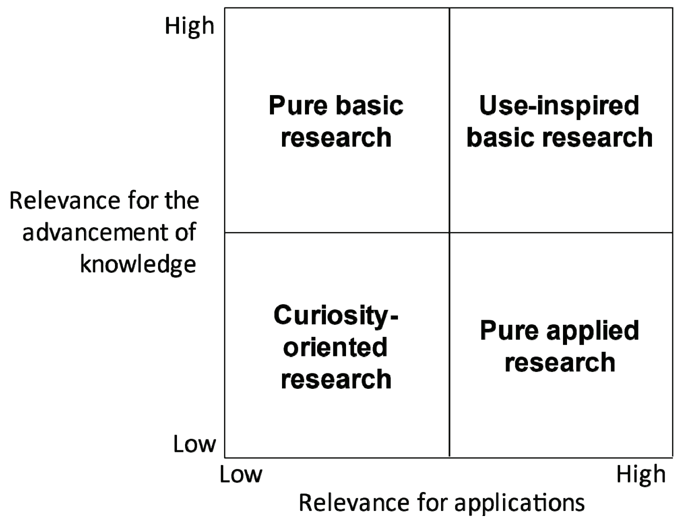

Figure 1: Quadrant model of scientific research.
Adapted from Stokes 1997, 73.

Th**e objective of this dissertation** is to develop a dynamic, user-centric process model for business model design and change and to evaluate the model's ability to maintain a competitive advantage with evidence from the mobility sector. Another objective is to meet the requirements of basic and applied research. Stokes' quadrant model of scientific research illustrates how four types of research contribute to knowledge advancement and application relevance (Figure 1).[39] An example of pure basic research is the atom model by Bohr, which was never intended to be practically applied. Use-inspired basic research has a theoretical foundation but aims to be practically relevant. For ex-

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[36] See chapter 3.2.1.2 for the state of the art in business model dynamics and chapter 4.1 for the state of the art in theoretical concepts that integrate the dynamic, user-centric perspective of business models.

[37] Refer to Frankenberger et al. 2013a, 253–256. See also chapter 2.1 for characteristics of dynamic approaches.

[38] Refer to Wirtz et al. 2016, 50–51.

[39] Refer to Stokes 1997, 73.

ample, game theory can be applied to real-world problems, such as energy regulations, stock market, or insurance. Pure applied research does not advance general knowledge; instead, it focuses on real-world application, e.g. study of mixed strategies by management consultancies in a specific industry. The scientific approach of this dissertation is use-inspired basic and pure applied research.

By deductive reasoning,[40] this research creates a theoretically grounded process model for dynamic, user-centric business model design and change: **the business model cycle (BMC)**. The BMC is characterized by three hierarchies with different levels of abstraction and granularity.[41] These models determine the phases, underlying components, activities, connecting input, and output streams for dynamic, user-centric business model design and change. This will help practitioners in strategic management or marketing divisions to understand and apply:

- universal mechanisms of dynamic, user-centric business model design and change (BMC meta-model)
- abstract steps in the procedure of dynamic, user-centric business model design and change (BMC sub-model)
- specific process activities and data input and output within a business process diagram for dynamic, user-centric business model design and change (modeled instance of the BMC).

This dissertation will also describe secondary research and a case study to further increase the relevance of the findings to real-world applications. The case study will demonstrate all three process models and evaluate them in reference to the mobility sector.

1.3 Research questions and dissertation structure

In the previous chapter, the research gap and research objectives were defined. The leading **research question** of this dissertation is: How is a dynamic, user-centric process model for business model design and change configured?

This question will be divided into the following subordinate questions:

(1) What are the requirements of a dynamic, user-centric approach?
(2) What are the static, dynamic, and user-centric perspectives in business model theory?

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[40] Refer to Töpfer 2012, 63–64.
[41] See chapter 5.1.4 for BMC hierarchies and classifications.

(3) What are the universal mechanisms, phases, components, and input/output streams of a dynamic, user-centric process meta-model for business model design and change?
(4) What are the specific components, process steps, and input/output streams of a dynamic, user-centric process sub-model for the design and change of digitalized business models?
(5) What are the specific activities and input/output streams of a dynamic, user-centric business process for the design and change of digitalized business models?

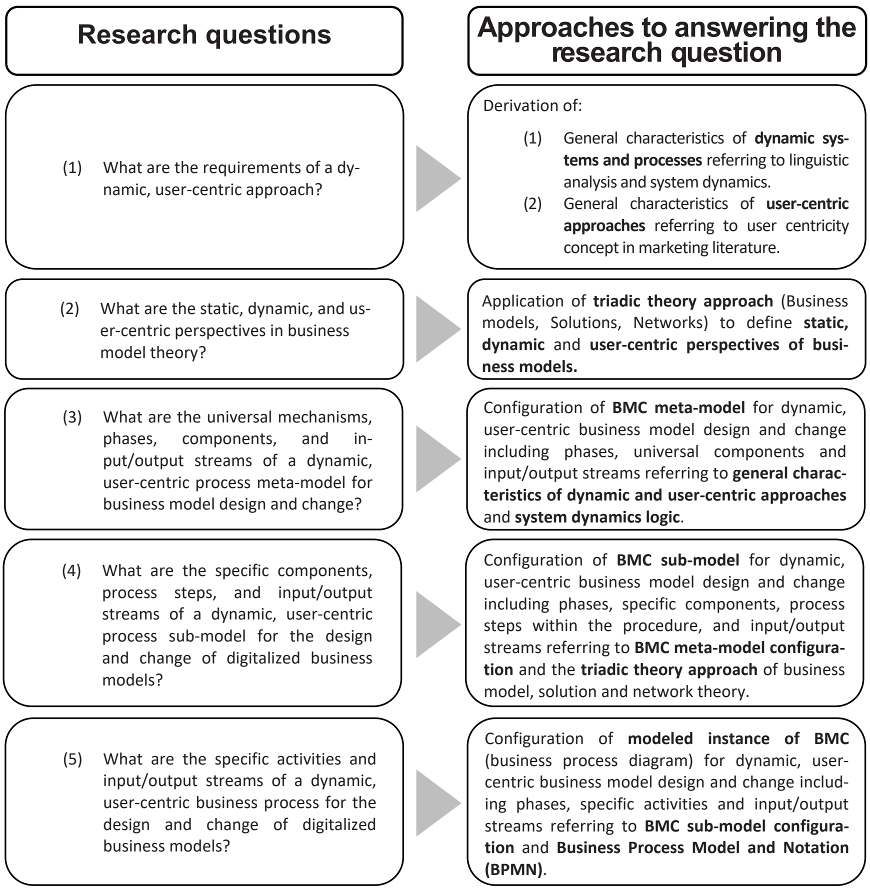

Figure 2: Research questions and corresponding approaches.

The dissertation aims to answer these questions to configure the BMC and its three hierarchical manifestations: BMC meta-model, BMC sub-model, and modeled instance of the BMC. The research questions and the corresponding solutions are illustrated with reference to applied theories and methodologies in Figure 2.

Requirements for dynamic systems and processes will be derived by linguistically analyzing key terms and by applying mechanisms of system dynamics. The characteristics of user-centric approaches will be determined by analyzing the literature on the user centricity concept. Scientific literature in the field of business models, solution marketing, and network theory will be examined to define a static, dynamic, and user-centric perspective of the business model concept. To configure the BMC meta-model, the general characteristics of dynamic, user-centric approaches (research question 1) will be combined with system dynamics logic. The BMC sub-model for digitalized business models will be based on the meta-model configuration and triadic theory, including business model, solution, and network theory. The modeled instance of the BMC will be based on the BMC sub-model configuration and BPMN business process modeling technique.

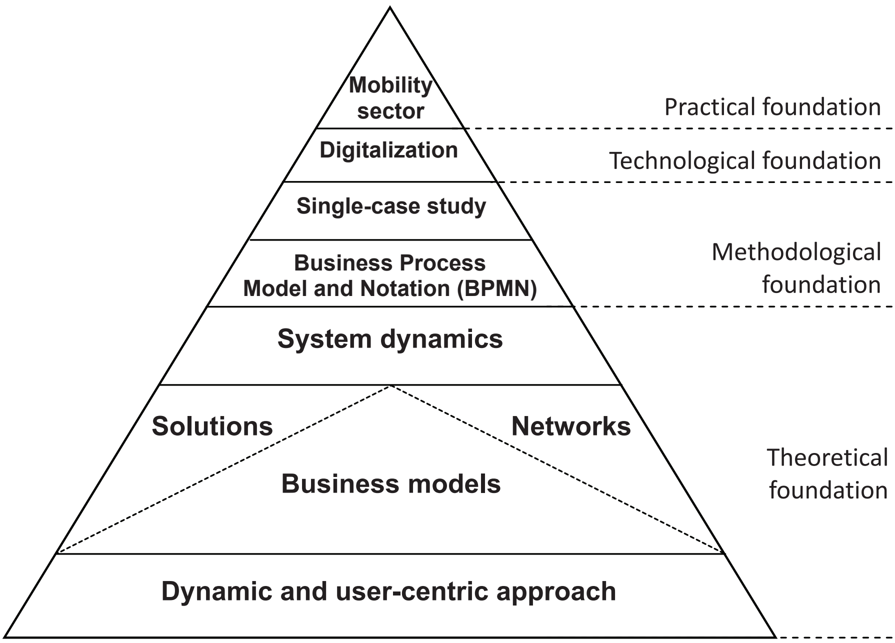

Figure 3: Research foundations.

The research objective is to develop a dynamic, user-centric process model for business model design and change and to meet the requirements of use-inspired basic and pure applied research as defined by Stokes.[42] Basic research will be implemented through deductive reasoning.[43] A theoretically grounded process model for dynamic, user-centric business model design and change (the BMC) will be configured. In ac-

[42] Refer to Stokes 1997, 73. Also see Figure 1.
[43] Refer to Töpfer 2012, 63–64.

cordance with the pure applied science approach, the BMC will be applied to a single-case study in the German mobility sector.

Figure 3 illustrates the research foundations that also map out the **dissertation structure**. Chapter 1.1 discusses the relevance of a dynamic, user-centric business model design and change in the face of ever-evolving external environments. It also describes the research problem, research objective, research questions, and structure of investigation. Chapter 2 defines the characteristics of a dynamic, user-centric approach, and includes a review of system dynamics logic and the user centricity concept. The findings from chapter 2 are applied throughout the dissertation and have been used to configure the BMC meta-model, sub-model, and the modeled instance of the BMC. Business models, solution marketing, and network theory have been examined to broaden the static, dynamic, and user-centric aspects of business models. Chapters 3.1 and 3.2 define business model definition, business model conceptualization, and business model design and change from a static to a dynamic point of view, business model dynamics, business model environment, and theory of dynamic consistency. Chapter 3.3 focuses on the user-centric configuration of business models, and applies solution marketing theory to business model value proposition. This includes a solution-centered specification of the offering, a user-centric, mixed-criteria segmentation approach, and the behavioral customer model as a means of delivering market solutions. Network theory is also examined to help with value creation and distribution of a user-centric business model. Focus was placed on the value network approach since it integrates the user into networked value creation and distribution.

Chapter 4 summarizes and concludes the theoretical foundation (Figure 3). It also describes the triadic theory (comprising business model, solution, and network theory), which summarizes the findings of chapter 3, and looks at the overlaps between the theories. The findings of scientific papers in these three research fields are analyzed, and this literature review substantiates the research gap and how the research questions were derived.

The BMC meta-model, sub-model, and the modeled instance of the BMC are discussed in chapter 5. System dynamics logic and the methodological foundation of Business Process Model and Notation (BPMN) as well as the technological foundation of smart digitalization technologies and techniques[44] are also applied in this chapter (Figure 3).

[44] Ambient intelligent environment, Internet of Things, big data analytics, artificial intelligence.

First, fundamental BMC configuration requirements are described based on the findings of chapter 2 and the logic of system dynamics. Meta-process models are also discussed since the BMC is a process model with distinct phases and underlying activities. To measure the BMC's scalability and to guarantee transferability to every industry and business, the model's architecture is analyzed using graph theory. The BMC has three hierarchies:

- The BMC meta-model, i.e. a universal process model for dynamic, user-centric business model design and change (chapter 5.2).
- The BMC sub-model, i.e. a specific process model for digitalized business models and their dynamic, user-centric design and change (chapter 5.3).
- The modeled instance of the BMC, i.e. a business process diagram for digitalized business models and their dynamic, user-centric design and change (chapter 5.4).

These models are developed by defining configuration requirements, describing methodology, and designing phases, components, activities, and input/output streams.[45]

Chapter 6 presents a case study of the business model of a mobility provider in the mobility sector. This provides a detailed exemplification of a theoretical BMC model (Figure 3). This case study is supported by a representative study on the multimodal customer.[46]

Chapter 7 highlights practical recommendations for strategic management and marketing practitioners, draws conclusions, and suggests future research.

[45] Every mentioned element cannot be applied to every BMC hierarchy because of differences in configuration requirements or methodological approaches.
[46] Refer to von Berg and Graff 2016; von Berg and Randelhoff 2019.

2 Definitions

This chapter not only lays the foundation for consistent terminology throughout this dissertation but also describes the factors involved in the business model cycle (BMC).

2.1 Dynamic

'Dynamic' has a multitude of meanings and affects diverse scientific fields. Thus, it is necessary to clarify exactly what is meant by the adjective 'dynamic' and which corresponding research domains are relevant in the context of this dissertation. The etymology of 'dynamic' goes back to the French word 'dynamique', which originates from Greek words 'dunamikos' (powerful) and 'dunamis' (power).[47] 'Dynamic' has different meanings in different fields, e.g. physics, electronics, music, and medicine.[48] However, the scope of this dissertation is the field of **systems and underlying process models**, so 'dynamic' is examined with reference to systems and processes (Figure 4).

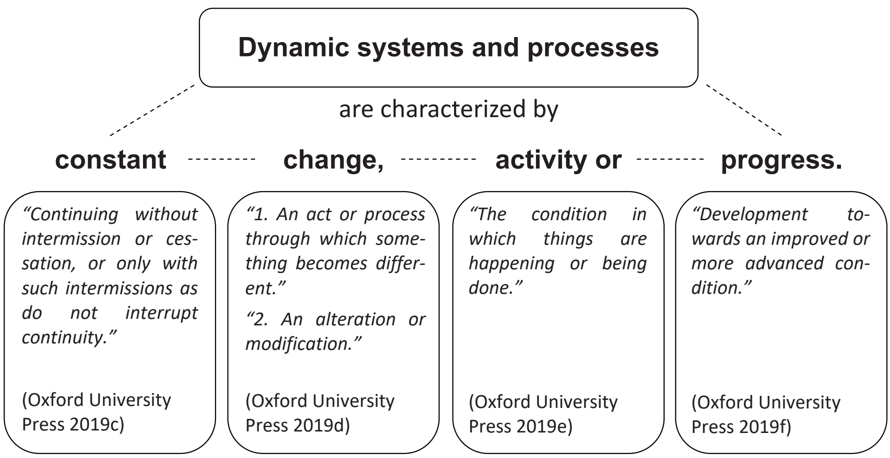

Figure 4: Dynamic systems and processes.

Defined as an adjective that describes processes or systems, 'dynamic' refers to "[…] constant change, activity, or progress."[49] This definition contains the adjective 'constant'

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[47] Refer to Houghton Mifflin Harcourt Publishing Company 2019.

[48] Physics: "Relating to forces producing motion.", Electronics: "(of a memory device) needing to be refreshed by the periodic application of a voltage.", Oxford University Press 2019a; Music: "Of, pertaining to, or indicating the volume of sound from a musical instrument or in a musical performance.", Medicine: "Functional, in contradistinction to organic; as in dynamic disease.", Oxford University Press 2019b.

[49] Oxford University Press 2019a. Synonymous meanings refer to HarperCollins Publishers 2019; Houghton Mifflin Harcourt Publishing Company 2019; Merriam-Webster 2019.

which describes the nouns ‘change’, ‘activity’, and ‘progress’. When referring to actions, conditions, or processes, ‘constant’ means continuing without intermission (or with intermissions that do not interrupt continuity).[50] The antecedents ‘change’, ‘activity’, and ‘progress’ are uncountable nouns. ‘Change’ refers to how something becomes different.[51] ‘Activity’ means something that is happening or has been done,[52] and ‘progress’ refers to development towards improvement.[53]

Based on these definitions, dynamic systems and processes are characterized by:

(1) continuousness
(2) activity, change, or progress.

These systems and processes are within the scope of the multi-theory **systems approach**, which will be used in this thesis. The dynamic strands of systems thinking rely strongly on feedback.[54] Feedback loops are embedded in systems where actions produce information that return to the source of the action. Feedback information is not the same as the original output information, and can cause further actions.[55]

Figure 5 illustrates the concept of feedback and the event-oriented model. The **event-oriented model** (A) represents a chain of cause and effects. The underlying logic assigns a cause to every event and a solution to every problem.[56] For instance, an average travel time ‘x’ is depicted on a road from A to B. The planner’s goal is to travel in 30% less time along this route. The discrepancy of 30% (or the problem in itself) is caused by congestion. The solution fix includes the decision to increase the road’s capacity, which leads to building a new lane and reduces congestion and travel time.

[50] Refer to Oxford University Press 2019c.
[51] Refer to Oxford University Press 2019d.
[52] Refer to Oxford University Press 2019e.
[53] Refer to Oxford University Press 2019f.
[54] Refer to Richardson 1991, 296; Schwaninger 2009, 8976–8977.
[55] Refer to Richardson 2009, 8968.
[56] Refer to Sterman 2000, 10; Morecroft 2015, 32–34.

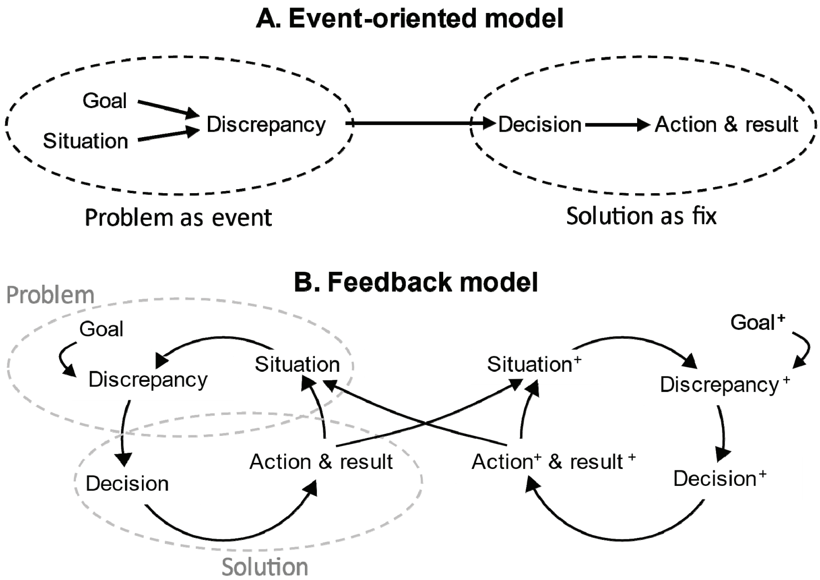

Figure 5: Event-oriented versus feedback view.
Adapted from Morecroft 2015, 32–37.

The **feedback model** (B) draws a path not only from problem to solution but also from solution to problem, since a current solution can cause a future problem. Actions entail results which determine our situation in the future. This changed environment always implies a reevaluation of the problem. Sterman, a main contributor to system dynamics, affirmed that "The system reacts to your solution."[57] A dynamic way of thinking is a circular way of thinking.[58]

The left feedback loop of B in Figure 5 also presents the events from problem to solution, but there are two main differences to the event-oriented model. First, actions and their results loop back to the situation. Second, these results input another loop, which sends its results back to the first feedback loop. If the solution to a problem is successful, the discrepancy between the current situation and goal decreases and the problem is moderated. This **circular feedback** guarantees a continuous process to achieve a specific goal.

The system reacts to actions with side effects. Actions and results from one feedback loop can affect the situation of another feedback loop and vice versa. Distinct feedback

[57] Sterman 2000, 10.
[58] Refer to Morecroft 2015, 37.

loops involve different players with different goals and processes. Processes in distinct feedback loops interplay with each other but are operated simultaneously. Thus, the dynamics of a complex system also involve **interlocking feedback**.[59]

Referring to the road example, the increase of road capacity (decision) decreases travel time by car (action and results) in the left feedback loop of B. The feedback loop on the right side of B receives this result and the situation^{+} changes: the attractiveness of driving a car increases. The goal^{+} is to use the most attractive means of transportation. The discrepancy^{+} lies in the currently low number of car trips (compared with the newly gained attractiveness). The decision^{+} is that people want to use the car more often and put their intention into action, resulting in (action^{+} and result^{+}) a higher traffic volume on the road. This new result^{+} is sent back to the feedback loop on the left and – with a delay – creates a situation where travel time by car increases again.

Both approaches describe the same road capacity example,[60] yet the event-oriented concept does not take any of the traffic system's dynamics into account. The feedback-oriented model, however, describes selected dynamic mechanisms of the induced demand theory where road capacity incites people to drive more, thus failing to improve congestion.[61]

Taken together, these linguistic examinations and dynamic systems approaches characterize dynamic models as feedback-oriented (including circular and interlocking feedback) or continuous processes of activity, change, or progress. In this context, a dynamic approach has processes and phases that are characterized by:

(1) **continuousness**
(2) **interdependency**
(3) **simultaneousness**.

2.2 User and customer

The term 'end user' initially evolved from product development in **information systems**. Here, an end user is "[…] the person ultimately intended to use a product, as opposed

[59] Refer to Forrester 1961, 14–17; Sterman 2000, 10–12; Richardson 2009, 8968–8969; Morecroft 2015, 32–38.

[60] The presented example is an altered and reduced version of the actual causal loop diagram on traffic volume by Sterman 2000, 182–183, which involves a multitude of other variables and side effects.

[61] See Lee et al. 1999 for induced traffic and induced demand.

to people involved in developing or marketing it."[62] In this sense, end users who did not adapt software were differentiated from software developers or suppliers.[63]

In **marketing** theory, the user of a product and/or service generates a value that forms when the product is used, i.e. the *value in use*.[64] For instance, the user unleashes the value in use of a manufactured car when they drive it using their driving skills and public roadways, whereas the customer buys the manufactured car but does not necessarily use it.

Osterwalder developed the 'business model canvas' in 2004.[65] This model distinguishes between users and customers and discusses their impact on **business model design**. In his 'business model alchemist' blog,[66] Osterwalder states that "Customers are simply users who pay for the value that is created for them in the form of a revenue stream for the company."[67] Hence, customers and users can belong to the *same group* (e.g. car buyers and drivers), a *similar group* (e.g. freemium business models), or a *distinct group* where one group subsidizes another group (e.g. Google). The freemium business model offers free and premium services.[68] The users use the free services; the customer group is a subset of the user group since it uses the free services but also buys additional premium services. Google's search engine business model relies on its free user group, since it attracts the paying customer group (advertisers). On the other hand, the advertising companies subsidize the users who use the service at no charge.[69]

Although users and customers can belong to the same, similar, or distinct target groups within a business model, 'user' is preferably used to 'customer' in the **terminology of this dissertation** because the primary focus is on the user group and their use processes. For instance, 'value in use' states that users experience an offering's true value when they use it.[70] 'Point of use' (PoU) represents the environment in which the user uses the products and/or services.[71] This goes beyond the simple act of purchasing a

[62] Douglas et al. 2009, 171.
[63] Refer to Lieberman et al. 2006, 1–2.
[64] Refer to Vargo et al. 2008, 148.
[65] Refer to Osterwalder 2004; Osterwalder and Pigneur 2010.
[66] Refer to Osterwalder 2010.
[67] Refer to Osterwalder 2010.
[68] Refer to Teece 2010, 178.
[69] Refer to Osterwalder 2010.
[70] Refer to Vargo et al. 2008, 148.
[71] See chapter 3.3.1.4. for the PoU concept.

product and/or service at the 'point of sale' (PoS). The 'behavioral customer model' focuses on the use and not the purchase of the product.[72] Here, the provider can monitor and analyze the user's behavior (e.g. driving data) to offer smart services (e.g. telematic-based insurance service). In this dissertation, the customer is always a user, but the user is not always a customer.

2.3 User-centric

To define the elements of user-centric approaches, the well-recognized concept of **customer centricity** must be examined in detail. Customer centricity evolved from a new business philosophy in management and marketing publications of the 1950s and 1960s when the strategic focus shifted from selling products to fulfilling customer needs.[73] User-centric marketing intends to understand user needs, wants, and resources to provide an offer that satisfies the customer. Marketers with a user-centric focus decide whether a standardized product or a customized solution best fulfills the user's perceived benefits.[74] However, customer centricity goes beyond reactive strategies, such as understanding customer needs and translating them into products and services. It calls for integrative practices, such as customer co-creation, where the user is involved in product design, production, or usage.[75] The latter is the 'value in use'.[76] Furthermore, customer centricity takes behavioral analytics into account not only to reveal relevant user needs but also to anticipate future needs.[77]

Fader produced a widely-cited **definition of customer centricity**: "Customer centricity is a strategy that aligns a company's development and delivery of its products and services with the current and future needs of a select set of customers in order to maximize their long-term financial value for the firm."[78] The author stresses the importance of distinguishing customers from one another by their heterogeneous needs and value to the company.[79] Fader also highlights a continuous and bidirectional relationship manage-

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[72] See chapter 3.3.1.4 for the behavioral customer model.
[73] Refer to Sheth et al. 2000, 55–56; Shah et al. 2006, 113; Lamberti 2013, 589; Kalka and Abel 2018, 4.
[74] Refer to Sheth et al. 2000, 56–57.
[75] Refer to Sheth et al. 2000, 62; Lamberti 2013, 594.
[76] Refer to Vargo et al. 2008, 148.
[77] Refer to Fader 2012, 27; Lamberti 2013, 594; Kalka and Abel 2018, 14.
[78] Fader 2012, 39.
[79] In terms of customer value, Fader refers to 'customer lifetime value', which "[…] is the present value of the future (net) cash flows associated with a particular customer", Fader 2012, 72.

ment and gathering of customer information to serve customers and their needs individually.[80]

Shah et al. defined customer-centric as the opposite of **product-centric** (Table 1).

	Product-centric	**Customer-centric**
Basic philosophy	Sell products	Serve customers
Business orientation	Transaction-oriented	Relationship-oriented
Product positioning	Highlight product features and advantages	Highlight product's benefits in terms of meeting individual customer needs
Organizational structure	Product-related (product profit centers, product managers, product sales team)	Customer-related (customer segment centers, customer relationship managers, customer segment sales team)
Organizational focus	Internally focused	Externally focused
Performance metrics	Product-related (number of new products, profitability per product, market share by product/sub-brands)	Customer-related (share of wallet of customers, customer satisfaction, customer lifetime value, customer equity)
Management criteria	Portfolio of products	Portfolio of customers
Selling approach	How many customers can we sell this product to?	How many products can we sell this customer?
Customer knowledge	Customer data are a control mechanism	Customer knowledge is a valuable asset

Table 1: Product-centric versus customer-centric approach.
Adapted from Shah et al. 2006, 115.

Table 1 highlights the differences in management of strategic and operational issues between product-centric and customer-centric approaches. Shah et al. concluded "[…] that the true essence of the customer centricity paradigm lies not in how to sell products but rather on creating value for the customer and, in the process, creating value for the firm."[81]

Customer centricity is widely associated with **market orientation**, but literature reveals fine distinctions between both approaches. Sheth et al. observed antecedents of the customer centricity concept in the market-oriented management approach.[82] Benkenstein drew no distinction between market orientation and customer centricity, claiming instead that customer centricity management is merely another term for market-oriented management. The author argues that both concepts aim to align the firm

80 Refer to Fader 2012, 115–116.
81 Shah et al. 2006, 115.
82 Refer to Sheth et al. 2000.

(and its staff) with its customers' needs.[83] In contrast, Lamberti claimed considerable differences between customer-centric and market-oriented management. Customer centricity includes bidirectional communication and interaction with individual customers. This exceeds the market-oriented approach of gathering general market intelligence and sharing this information among functions. Customer-centric approaches try to dissolve functional boundaries and create customer-centered processes. Another major difference is customer co-creation – customer-centric approaches integrate customers in the value chain and utilize their resources to co-create value (e.g. in product design). In contrast, market orientation is guided by customer orientation, i.e. the translation of customer needs into a functional product or service; essentially, market orientation responds to customer needs while customer centricity collaborates with the customer.[84] Lamberti concluded that "[…] if customer centricity implies a market orientation, the opposite cannot be taken for granted."[85]

Lamberti suggested a distinctive customer centricity concept with four dimensions: interactive customer relationship management (CRM), customer integration, internal integration, and external integration. Interactive CRM establishes trust between firm and customer through interactive communication and an adaptive acquisition of user needs and preferences. Customer integration, on the other hand, is a participatory process where customers co-create and customize which and how products and/or services reach them. Internal and external integration target adjustments in organizational structure to enable customer centricity. Internal integration organizes the collection and distribution of customer information at all customer touch points by managing an overarching interface. External integration involves either a collaboration between the customer's and the firm's supply chain to reach the highest possible customization or a downward alignment where customer-centric strategies and procedures are implanted in the firm's trade or intermediary network to guarantee a positive customer experience at their final touch points.[86]

Kalka and Abel highlighted the impact of progressive **digitalization** on customer centricity. Digitalization has increased the number of communication channels and platforms. The customer has taken on a new role in the communication process and is no

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[83] Refer to Benkenstein 2018, 59–60.
[84] For this paragraph, refer to Lamberti 2013, 597.
[85] Lamberti 2013, 597.
[86] Refer to Lamberti 2013, 596–599.

longer just the message recipient. The digitally enabled, network-based interaction model allows both firms and customers to send and receive messages or information. Digitalization amplifies the quality of targeted customer communication and significantly facilitates the customization of offerings and exchangeability of products and services. Information overload and new communication mechanisms have repressed former product- and brand-centric strategies. Kalka and Abel conclude that companies should focus on managing customer relations, including the entirety of interactions and experiences throughout the customer lifecycle. This strategy enhances their brand image and increases customer loyalty. Digitalization has made this easier.[87]

Gerdes has suggested possibilities of digitalization beyond new communication and interaction channels and their impact on customer centricity. He draws attention to a multitude of new user data sources (e.g. social media) as well as data gathering and analytics techniques (e.g. data mining, real-time analytics).[88] Pinkwart claims that companies can get new insights into the customer journey and lifecycle through digital interaction. Communication has become customer-centric because providers can specifically target their information at customers according to content, time, location, and customer demand.[89] Additionally, customers can actively participate in digital open innovation processes.[90] Zinkan and Mahadevan have suggested that real-time data gathering, data processing, and result implementation will make co-creation of new products and/or services a nearly automatic and permanent process.[91]

Modularization of offerings is another digitally enabled customer-centric aspect. For instance, online configurators allow the customer to choose predefined modules to customize their solution based on their individual needs and preferences.[92] In another example, modularized products contain components that can be changed or upgraded. *Tesla*, for example, offers 'situational updates' for their cars, e.g. for their autonomous driving software. The customer can purchase and download these modules depending on their demand and budget. The provider must communicate these offerings when

[87] Refer to Kalka and Abel 2018, 4–6.
[88] Refer to Gerdes 2018, 190–194.
[89] Refer to Šimůnková 2019, 65.
[90] Refer to Gerdes 2018, 191–193; Pinkwart 2018, 359.
[91] Refer to Zinkann and Mahadevan 2018, 167.
[92] Refer to Gerdes 2018, 190–191.

customer demand for the service evolves.[93] Kalka and Abel concluded that digitalization not only enables customer centricity but also forces companies to adopt customer-centric approaches to stay competitive in the digital era.[94]

Collectively, these findings outline several overlaps to the meaning of ‘user-centric’. Two enabling and three constituting elements of user-centric concepts can be derived. Organizational integration (internal and external) and data integration are the **enabling factors**. A user-centric provider should adapt their organizational structure towards internal and external integration. *Internal integration* involves restructuring function-centered processes into user-centered ones. The entirety of user touch points within the company should be aligned in an overarching interface. *External integration* gears towards aligning the provider’s and the user’s supply chain. Users and their value-producing resources must be incorporated into the provider’s value creation and distribution system.[95] *Data integration* includes digital communication and interaction channels. Additionally, user data must be gathered, processed, and analyzed.

The **constituting elements** of user-centric approaches include bidirectional communication and interaction, proactive customization, and user integration. *Bidirectional communication and interaction* enables both the user and the provider to send and receive messages and information. Messages and information can be directed to a specific user. Bidirectional communication and interaction also allow the user and provider to collaborate. *Proactive customization* focuses on users’ needs and needs-oriented market segmentation and translates these needs and preferences into products and/or services. In addition, proactive – and hence collaborative – customization identifies changing user demands and implements modularized solution offerings. *User integration* involves users in different decision-making processes, such as product or service design. Users use their assets and actively co-create value within an integrated value creation and distribution system (organizational integration).

Throughout this dissertation, a user-centric approach comprises

enabling factors:

(1) organizational integration

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[93] Refer to Reinartz 2018, 135–136.

[94] Refer to Kalka and Abel 2018, 6.

[95] Users have dynamic operant resources (e.g. knowledge, skills, competences) at their disposal, which are used to activate, alter, or design operand resources (e.g. goods). Refer to Vargo and Lusch 2004, 7–12, 2006, 285; Vargo et al. 2008, 148.

(2) data integration

and **constituting elements**:

(1) bidirectional communication and interaction
(2) proactive customization
(3) user integration

3 Business models

3.1 Static perspective of business models

The static perspective of business models involves definitions, structures, and typologies. These terminologies and classifications are explained in this chapter. This static view includes fundamental elements for the business model cycle (BMC).

3.1.1 Business model theory

The business model theory was first mentioned in 1957, and evolved during the internet era of the mid-1990s. The scientific literature has made a growing number of contributions to the business model theory [96] and as a result different definitions and concepts for diverse business model conceptualizations exist.[97] In 2001, Magretta stated that a good business model answers "[…] age-old questions […]"[98] referring to targeted customer segments and offered value, which is the economic logic of value creation and value capturing mechanisms.[99]

Figure 6 displays the convergence of three business model theory streams: technological- (T_1, T_2), organizational- (O), and strategic-oriented (S) business model concepts. The levels of business model analysis range from a highly detailed and product-oriented view to a more aggregative and industry-related view (y-axis). The industry level allows for a holistic view of the business model, including the competitive environment and other external factors, while the subsequent levels support a higher granulation that is more suitable for highly diversified enterprises. However, these different levels are not mutually exclusive and can be used to analyze a firm with different degrees of abstraction, comprehensively capturing its profitability. The x-axis describes the business model's orientation towards operational process management, right up to a future-oriented strategic focus.[100]

[96] Refer to Zott et al. 2011, 1022; Wirtz et al. 2016, 37.
[97] See Wirtz et al. 2016 for a comparative literature review.
[98] Magretta 2002, 4.
[99] Refer to Magretta 2002, 4.
[100] Refer to Osterwalder et al. 2005, 9; Schallmo 2013b, 27; Wirtz 2013, 75–77.

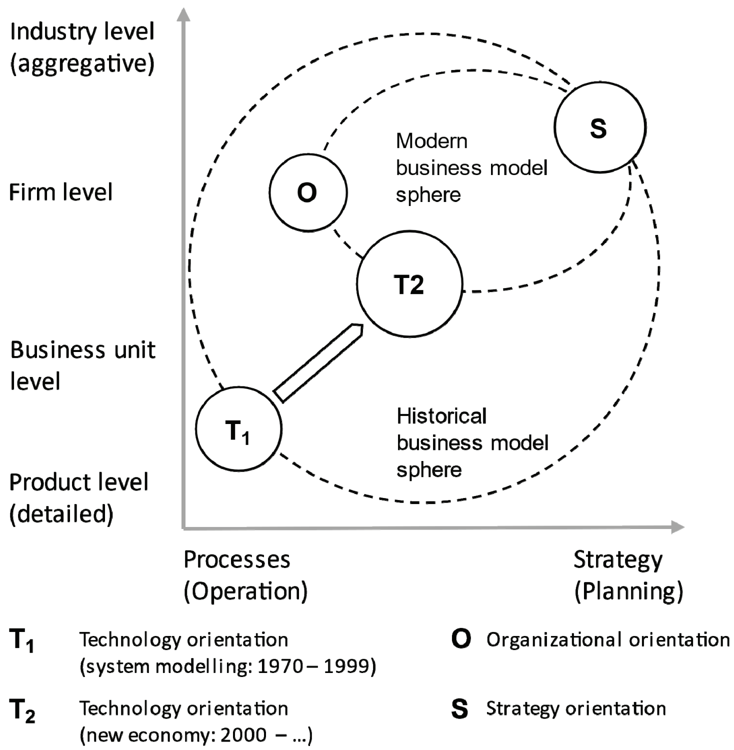

Figure 6: Convergence of business model theories.
Adapted from Wirtz et al. 2016, 39.

Technological-oriented business model concepts define the beginnings of business model literature. First, they describe business or system modeling in an information technology (IT) environment (T_1), always adopting a business-unit or product-level view. Within the context of the new economy, technologically oriented concepts take a more abstract view by applying the business model to emerging electronic businesses (T_2).[101] In the 1990s, organizational business models arose and slowly replaced technology-related system modeling approaches (O).[102] The organizational-oriented business model is linked to organizational theory and should reflect the firm's architecture. Here, the internal view of companies is used as an analytical and planning-related management tool. Strategy-related business model concepts are often associated with innovation topics (S).[103] They expand the inbound firm view by competitive and other external fac-

[101] See Timmers 1998; Afuah and Tucci 2003.
[102] See Linder and Cantrell 2001.
[103] See Chesbrough and Rosenbloom 2002; Zott and Amit 2008; Osterwalder and Pigneur 2010.

tors. Hence, cooperative creation of value and a more holistic view of managerial activities come into focus. Wirtz et al. argued that more recent publications have converged the findings of all three streams into a similar understanding of the business model concept.[104]

The business model concept is strongly connected to two prominent views in management theory: the market-based view[105] and the resource-based view[106]. The market-based view focuses on the industry as the main objective of analysis. The firm's competitive advantage is a function of its position within the industry, and is formed by the interplay of various external variables and the competitive environment. In comparison, within the resource-based view, the firm is the center of analysis. Here, the competitive advantage builds on rare, difficult-to-imitate capabilities and resources a firm has aggregated.[107] Wirtz argues that formerly contrary views are often complemented because authors aim for a holistic, strategic foundation for business model theory.[108] Dyer and Singh have offered a relational view of competitive advantage and explain that "[…] a firm's critical resources may extend beyond firm boundaries […]"[109], pointing out the resources and value that lie within external relationships.

In terms of application, the business model concept offers multifaceted options in management practice and research.[110] Both in research and in practice, business models that provide a compact and simplified outlay of fundamental business activity and value creation elements can serve as an analytical tool. On the one hand, managers can systematically compare business models across industries to study and adopt best practices. On the other hand, scientists conduct detailed case studies to derive new theories and taxonomies. In terms of innovation and change of business operation, the business model can simplify systematic planning. It supports the manager with a predefined framework and adjustable elements which provide a guideline for business model innovation and improvement. Finally, the business model concept can be used for internal

[104] Refer to Wirtz 2013, 30–31; Wirtz et al. 2016, 38–65.
[105] See Porter 1980.
[106] See Wernerfelt 1989, 1995; Barney 1991; Peteraf 1993.
[107] Refer to Dyer and Singh 1998, 660; Kujala et al. 2010, 98; McGrath 2010, 248.
[108] Refer to Wirtz 2013, 17.
[109] Dyer and Singh 1998, 660.
[110] Refer to Baden-Fuller and Morgan 2010, 156.

and external (e.g. with investors) communication since it lays down business operations and objectives in a form that is easily comprehensible.[111]

Following Bieger and Reinhold, the business model definition in this dissertation stresses the creation of value. Business models describe the logic of value creation by mapping out the value proposition towards users as well as relevant structures and mechanisms to create and distribute value.[112] Referring to the abovementioned conglomeration of market- and resource-based views, the business model concept used in this dissertation combines two aspects: it highlights the resources needed for value creation, and integrates several players – particularly the user – and their roles, assets, and transactions within a value network that goes beyond the boundaries of its focal firm. Taken together, the business model can explain how and where value is originated, co-created, and distributed.[113]

3.1.2 Business model conceptualization

Numerous publications have described various business model conceptualizations made up of elements grouped into components.[114] The **configuration of a business model** offers a framework from which business model components and their underlying elements can be chosen for a defined purpose or specific business model (Figure 7).

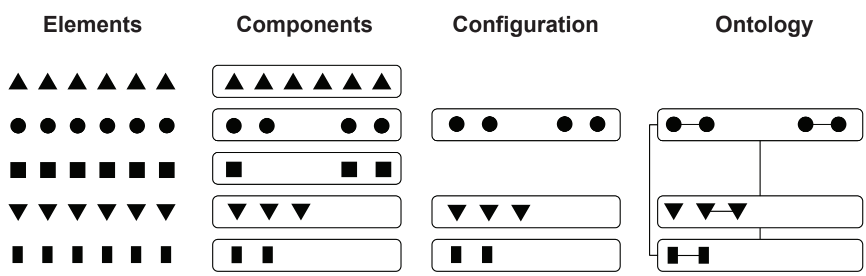

Figure 7: Business model conceptualization.

A business model configuration lists the entirety of relevant business model *components*, such as value proposition, value creation and distribution and their underlying

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[111] See Amit and Zott 2001; Magretta 2002; Bieger and Reinhold 2011.

[112] Refer to Bieger and Reinhold 2011, 11–70.

[113] Refer to Dyer and Singh 1998, 660–661; Amit and Zott 2001, 503; Chesbrough 2010, 355; Zott et al. 2011, 1029; Palo and Tähtinen 2013, 774.

[114] See Morris et al. 2005, 728; Shafer et al. 2005, 201; Schallmo 2013b, 49–50; Wirtz et al. 2016, 43 for comprehensive literature analysis on business model elements and their comprising components.

elements, such as user segments, specification of the offering, assets, transactions etc.[115]

The **business model ontology** represents an explicit specification of a business model conceptualization. It captures a business model's specific logic of value creation, including the interdependence of its components and underlying elements.[116] For instance, in 2004 Osterwalder developed a business model ontology that consisted of nine interrelated business model components: *the business model canvas*.[117]

Depending on the analysis level (Figure 6) and the general context, business models incorporate from three[118] to six (or more)[119] components. Within a recent literature review, Wirtz et al. identified nine different business model components: strategy, resources, network, users (role, user interface), market offering (value proposition), revenues, service provision (activities, processes), procurement, and finances.[120] One of the most frequently used components is the 'market offering' – a strongly market- and user-centric component also known as 'value proposition'. Most authors integrate a 'resources' component into their business models. These comprise intangible and tangible resources for value creation. The authors discovered that most business models adopt a high level of abstraction and keep the number of components to a minimum; only 30% take on a more comprehensive and detailed view with more components.[121] In this context, Zollenkop differentiates between business models that have strategic or operative management practices.[122]

The business models examined in this dissertation are strategic in terms of their use as a planning tool rather than a detailed operative description of business processes. Nevertheless, a modeled business process is presented in this thesis to visualize the specific, ordered activities involved. The abstraction level is high, so the number of components should be kept to a minimum. However, the business model should be both user- and network-centric, so purpose, origin, creation, and distribution of value

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[115] For this paragraph, refer to Schallmo 2013a, 117–119.

[116] Refer to Gruber 1993, 199; Osterwalder 2004, 39–41.

[117] Refer to Osterwalder 2004; Osterwalder and Pigneur 2010.

[118] See Mahadevan 2000; Amit and Zott 2001; Hamel 2001; zu Knyphausen-Aufseß and Meinhardt 2002; Voelpel et al. 2004.

[119] See Wirtz 2000; Chesbrough and Rosenbloom 2002; Osterwalder et al. 2005; Osterwalder and Pigneur 2010; Bieger and Reinhold 2011; Wirtz et al. 2016.

[120] Refer to Wirtz et al. 2016, 41–43.

[121] Refer to Wirtz et al. 2016, 42.

[122] Refer to Zollenkop 2006, 44–46.

should be incorporated. The business model components should consider a systematic approach towards business model change since it is a dynamic planning tool.[123] Therefore, the business model configuration in this dissertation is based on three components (Figure 8): value proposition, value creation and distribution, and value development. These components encompass the following questions: what value is generated for whom?, how is value created and distributed?, and when and how should value be developed?

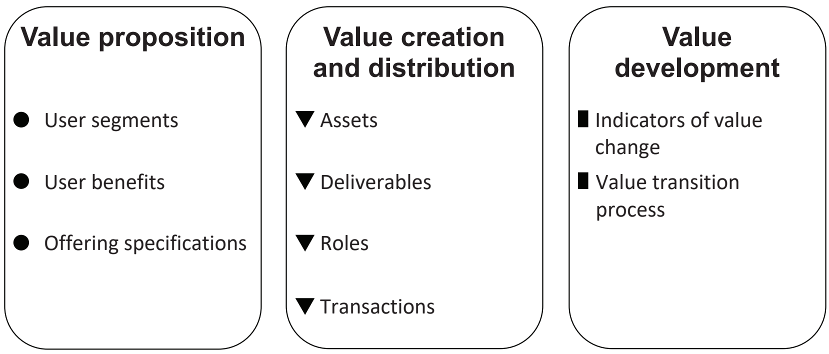

Figure 8: Business model configuration.

Value proposition is the benefit of using the market offering proposed to the user. It defines which products and/or services are combined into the market offering and the user segments that should be targeted. Accordingly, value proposition is composed of three components: targeted user segments, user benefits and the offering's specification.[124] There are many suitable marketing approaches, and a comprehensive review of potential value proposition configurations is beyond the scope of this dissertation. Diverse market segmentation[125] and offering[126] as well as different schools of thought in marketing[127] provide endless combinations.

[123] See Morris et al. 2005, 732–733; Cavalcante et al. 2011, 1328; Putten et al. 2012, 140; Saebi 2015, 145–146; Wirtz et al. 2016, 39–41 argue that most business model approaches are conceptualized in a static manner and/or state and that there is a need to incorporate dynamics of business model change into these configurations.

[124] Refer to zu Knyphausen-Aufseß and Meinhardt 2002; Morris et al. 2005; Bieger and Reinhold 2011.

[125] For instance, traditional market segmentation concepts that use geographical, demographic, or volume-of-consumption criteria versus the "benefit segmentation" approach (see chapter 3.3.1.3).

[126] For instance, "Leistungs- und Kundensysteme" (Belz 1997) and "Solutions" (see chapter 3.3.1.2).

[127] For instance, "goods-dominant logic" versus "service-dominant logic" (see chapter 3.3.1.1).

Value creation and distribution determines the logic, configuration, and distribution of added value within a network.[128] Following Zott and Amit, the business model's value creation goes beyond "[…] value chains, the resource-based view, transaction cost models, and even strategic network theory […]"[129]. It defines a value network that incorporates assets, roles, and transactions to fulfill the value proposition.[130] These assets are not only at firm level; external, internal, tangible, and intangible assets define the roles (e.g. suppliers, complementors, competitors, distributors, users) and relationships of their holders, who combine them on a network level to create joint value. The value network is set up by a focal firm; every network partner must translate their resources into intangible (e.g. knowledge, information, and loyalty) or tangible (e.g. goods, services and any form of revenue) value, but above all negotiable value that becomes the network's currency. Hereby, transactions distribute value within the network.[131]

Wirtz regards revenue as a tangible value, and has classified them into direct and indirect as well as transaction-dependent and transaction-independent revenues.

	Direct revenue generation	**Indirect revenue generation**
Transaction-dependent	Transaction revenue (s. str.) Usage fee	Commission
Transaction-independent	Set-up fee Basic fee	Advertising Data-mining revenue Sponsorship

Table 2: Classification of revenue streams.
Adapted from Wirtz 2013, 142.

Table 2 displays a matrix of value stream examples. Transaction-dependent revenues are taken only if a product is purchased or a service is used. Transaction-independent revenues are not linked to the transaction's time, frequency, or length. For instance, a basic fee (e.g. flat rate, standing charge) is usually charged periodically no matter how often the service is used, whereas one-time monetary revenues as well as usage, set-up, or basic fees are direct revenues that often refer to the end consumer. Commis-

[128] Refer to Bieger and Reinhold 2011, 37–52.
[129] Zott and Amit 2009, 259.
[130] See chapter 3.3.2.
[131] Refer to Norman and Ramirez 1993, 69–70; Allee 2000, 37; Gomes-Casseres 2003, 328–332; Vanhaverbeke and Cloodt 2006, 259–274; Allee 2008, 9–14; Wirtz 2013, 97.

sions, advertising, data mining, and sponsorship are indirect revenue types often used in business-to-business (B2B) constellations.[132]

Bieger and Reinhold incorporate a *value development* component into their business model configuration that should stay abreast of required changes in value and hence in the business model configuration.[133] Value development determines the indicators of value change (e.g. changing external factors such as user needs) and the value transition process, answering the question of how value is continuously refined during and after setting up the business model.[134] Burianek et al. specify the necessity for value transitions regarding value proposition. The market offering should never be static, but adaptable over time. The offering needs to be modified according to user needs, technological innovations, and/or internal structural changes.[135]

3.1.3 Statics in business model design and change

There is a degree of uncertainty around the terminology in business model design and business model change; a static or a dynamic – i.e. process – perspective can be applied to both. This chapter outlines the static view of business model design and change.

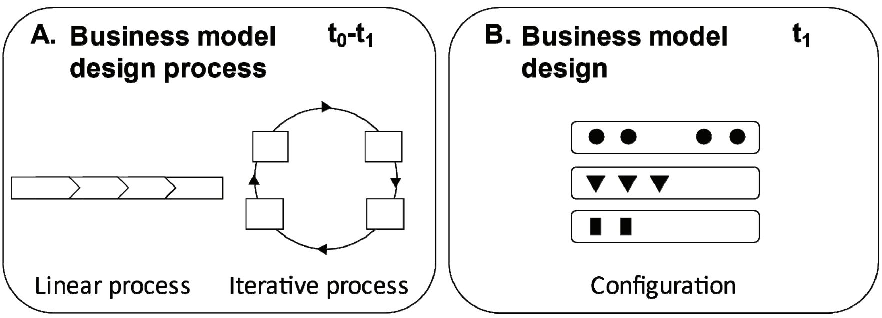

Figure 9: Statics in business model design.

Wirtz has pointed out that **business model design** not only describes how business models are designed but also how these designs are visualized.[136]

[132] Refer to Wirtz 2013, 142.
[133] Refer to Bieger and Reinhold 2011, 52–56.
[134] Refer to Bieger and Reinhold 2011, 52–56; Saebi 2015, 145–148; Saebi et al. 2017, 567–570.
[135] Refer to Burianek et al. 2007, 20–22.
[136] Refer Wirtz et al. 2016, 45–47.

Figure 9 illustrates the differences between the process of business model design and the graphical depiction of a designed business model configuration. The design process and its underlying activities take place during a time window, from t_0 to t_1.(A). The process starts at t_0 and the business model design is market-ready at t_1. The business model design captures the components and underlying elements of the model at specific time points (static view, B).[137] Throughout this dissertation, business model design from a static perspective refers to a particular business model configuration at a specific point in time that results from the process of business model design.[138]

The static view of **business model change** mainly determines the intensity of change. There are a variety of typologies in the field of business model change.[139] These include 'business model change' and 'business model innovation', which tend to be used interchangeably.[140] Saebi has pointed out that, in organizational change theory, episodic, discontinuous, and intermittent change is the opposite of continuous, evolving, and incremental change.[141] Throughout this dissertation, innovative and evolving change are considered a continuum of business model change.

Based on an extensive literature review, Saebi examined several terminologies and distinguished between three *types of business model change*: evolution, adaptation, and innovation (Table 3).[142]

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137 Refer to Gruber 1993, 199; Osterwalder 2004, 39–41; Demil and Lecocq 2010, 227–228 and see Figure 7.

138 Refer to chapter 3.1.2 for business model configurations, particularly Figure 7.

139 For instance: Wirtz developed five change models (stabilization model, evolution adaption model, extension model, migration model, radical innovation model) as development paths for business models that range from no change to moderate and strong change to radical shift. Refer to Wirtz 2018, 324–327. Santos et al. differentiated between eight types of business model change that are divided into four classifications: reactivating, relinking, repartitioning, and relocating. Refer to Santos et al. 2015, 47–48. Linder and Cantrell determined four change models – realization, renewal, extension, and journey – depending on the degree to which the business model's core logic changes. Refer to Linder and Cantrell 2000, 10–14.

140 For instance, Mitchell and Coles classified business model innovation, i.e. business model improvement, catch-up, replacement, and actual innovation, which draws distinct similarities to typologies or models of business model change (see Footnote 139). Refer to Mitchell and Coles 2003; Schaltegger et al. 2012.

141 Refer to Saebi 2015, Footnote 1.

142 Refer to Saebi 2015, 148–151.

	Business model evolution	Business model adaptation	Business model innovation
Planned outcome	Natural, minor adjustments	Align with the environment	Disrupt market conditions
Scope of change (business model components affected)	Narrow	Narrow – wide	Wide
Degree of radicalness	Incremental	Incremental – radical	Radical
Frequency of change	Continuous, gradual	Periodical	Infrequent
Degree of novelty	Not applicable	Novelty is not a requirement	Must be novel to the business or industry

Table 3: Types of business model change.
Saebi 2015, 150.

Business model evolution describes a process of continuous but incremental improvement that aims to increase efficiency in terms of activities, relations, and operations.[143] The continuousness of business model evolution is linked to its objective of being an "[…] effective standardization, replication, and maintenance of the existing business model."[144]

Business model adaptation is the result of environmental changes that affect the business model to different degrees.[145] However, novelty – i.e. a business model (or parts of it) that is new to the world, market, or company –[146] is not a necessary requirement for business model adaptation.[147]

In contrast, *business model innovation* affects the environment by shaping markets and industries. Disruptive innovations mostly involve simultaneous changes to several business model components that may either entail a fundamental reformation of the existing business model or the innovation of a new business model.[148]

Throughout this dissertation, business model change refers to a continuum of distinct alterations to the business model, from business model evolution to business model adaptation and business model innovation.

[143] Refer to Saebi 2015, 150.
[144] Saebi 2015, 157.
[145] Environmental changes stem from the dynamics within the business model environment. See chapter 3.2.2.
[146] Refer to Stampfl 2016, 39.
[147] Refer to Saebi 2015, 150.
[148] Refer to Wirtz 2013, 149–151.

3.2 Dynamic perspective of business models

The dynamic perspective of business models is centered around processes and their underlying activities. This chapter considers the dynamics of business model design and change.

3.2.1 Business model dynamics

3.2.1.1 Definition of business model dynamics

Business model dynamics primarily describe the need for business models to adapt along with their *changing environment* to stay competitive over time.[149] However, business model dynamics also includes *internal factors* relevant to business model change. These internal factors, such as management decisions, mostly aim for operational efficiency and can trigger business model change.[150] As well as *continuous change*, business model dynamics also include *radical and intermittent changes*, such as business model innovation.[151] Wirtz et al. examined the literature on business model dynamics and concluded that "[…] a current business model should always be critically regarded from a dynamic perspective, thus within the consciousness that there may be the need for business model evolution or business model innovation, due to internal or external changes over time."[152]

Business model core components are the *subject of change*.[153] Although different business model core components have been described in the literature, 'value proposition' and 'value creation' are common denominators.[154] Demil and Lecocq described *dynamic consistency*, which focuses on harmonizing the business model's core elements. Dynamic consistency is a balanced state where the business model's configurational fit – and thus its effectiveness and performance – is in line with the external dynamics.[155] A configurational fit between business model components refers to aligned elements that

[149] Refer to Linder and Cantrell 2000, 10; Schweizer 2005, 48; Demil and Lecocq 2010, 241; Putten et al. 2012, 140; Achtenhagen et al. 2013, 431–432; Saebi et al. 2017, 568–569.

[150] See chapter 3.2.2 for internal factors.

[151] Refer to Saebi et al. 2017, 568–569.

[152] Wirtz et al. 2016, 41.

[153] Refer to Demil and Lecocq 2010, 239–242; Wirtz 2018, 224.

[154] Refer to Wirtz 2018, 224–225.

[155] Refer to Demil and Lecocq 2010, 241–242.

create harmony and synergy, and secure the model's effectiveness.[156] Business model components are interdependent, create joint value, and reinforce each other (i.e. when the value of one component increases the value of another). The stronger the reinforcement between components, the better the configurational fit.[157] A balance between continuously changing external environments and the business model's internal dynamics is needed for dynamic consistency.[158]

These definitions of business model dynamics lack one aspect. Since business model dynamics are linked to a continuous evaluation of the business model, not only change but also the *cycle of business model design* should be considered.[159] Business model dynamics must involve recurring design activities (e.g. specifying business model components, prototyping) and change activities (e.g. monitoring external factors, determining the type of business model change).[160]

Throughout this dissertation, the **definition of business model dynamics** refers to the dynamic perspective of business models. This refers to continuously assessing and revising a business model in response to, or in anticipation of, changing external and internal factors and – if necessary – initiating business model change on a continuum from evolution to innovation. This includes designing a business model with dynamic consistency between its core components.

3.2.1.2 State of the art in business model dynamics

This dynamic perspective of business models has not been well discussed in the literature,[161] but has received more attention recently.[162] The following **overview of business model dynamics literature** is not fully comprehensive, but does give an overview of the diverse approaches in the field.

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[156] Refer to Magretta 2002, 6; Nenonen and Storbacka 2010, 51–52; Kindström and Kowalkowski 2015, 10.

[157] Refer to Nenonen and Storbacka 2010, 51–52; Storbacka et al. 2012, 64–65.

[158] Refer to Demil and Lecocq 2010, 241–242.

[159] Refer to Petrovic et al. 2001; Teece 2007, 1336; Demil and Lecocq 2010, 241; Zott and Amit 2010, 217; Amit and Zott 2012, 44–47; Wirtz et al. 2016, 45; Wirtz 2018, 263.

[160] The activities that form design and change processes are described in chapters 3.2.4.3 and 3.2.4.2.

[161] See de Reuver et al. 2009; Cavalcante et al. 2011; Ricart and Casadesus-Masanell 2011; Putten et al. 2012; Cosenz and Noto 2018.

[162] Refer to Wirtz et al. 2016, 40–41.

Commonly, business models map out a company's value creation logic at a specific point in time;[163] they provide stability and are meant to stay in effect for some time.[164] However, Stampfl pointed out that this rather static view of business models gradually gives way to the "[…] dynamism of business model innovation […]"[165].

Demil and Lecocq have differentiated between two different but complementary uses of the business model concept: the static and the dynamic view. The static business model is a framework for the overall business model structure and its essential components and their interdependencies (according to the ontology conceptualization). This dynamic view comprehends the logic of continuous business model change since the business model "[…] is permanently in a state of transitory disequilibrium […]"[166]. The authors bring these two approaches together with the 'RCOV framework' (resources, competences, organization, value proposition), which examines the interactions and feedback mechanisms within and between business model components. The framework reflects the changes within the business model configuration and their connection to its performance (revenue and cost). The main limitation of the framework is the lack of touch points with external factors that affect or interact with the business model components and the visualization of these interrelations.[167]

Cosenz and Noto introduced the 'dynamic business model framework', which is similar to Demil and Lecocq's concept but is designed with more granularity.[168] The interdependencies between business model components and their underlying elements are illustrated in great detail. The framework can simulate the change of every variable and assess its impact on the business model's short- and long-term performance. The authors claim that their system can test different strategies and rapidly modify business models according to environmental changes. But the framework does not depict the triggers for change. Moreover, the relationships between external environmental factors, types of change (Table 3), and impacts on the business model are not demonstrated.[169]

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[163] See chapter 3.1.2 for business model configurations.
[164] Refer to Osterwalder et al. 2005, 15–16; Cavalcante et al. 2011, 1328; Putten et al. 2012, 140.
[165] Stampfl 2016, 54.
[166] Demil and Lecocq 2010, 240.
[167] Refer to Demil and Lecocq 2010, 234–242.
[168] Refer to Cosenz and Noto 2018, 131.
[169] Refer to Cosenz and Noto 2018, 129–139.

Morris et al. claimed that "[…] it is possible to envision a business model lifecycle involving periods of specification, refinement, adaptation, revision, and reformulation […]"[170], but offered no further explanation. Voelpel et al. gave a more specific description of their 'wheel of business model reinvention'.[171] Their model illustrates the interplay between users, value propositions, technology, business infrastructure, and economic profitability. The dynamic framework can be continuously adjusted to an existing business model but neglects the business model design. The model's phases run consecutively, and changing external factors and their potential impact on the business model are assessed in a default order. Continuous and simultaneous monitoring of external environmental factors is not considered.[172]

De Reuver et al. presented the 'dynamic business model framework'[173] and seized upon the idea of business model lifecycles. They stressed the importance of continuous business model reinvention during each phase of the lifecycle. The influence of three external drivers – technology, market, and regulation – on internal business model components was examined with respect to different stages of the business model lifecycle. Technological and market-sided innovations strongly influenced business model configurations during the research and development phase; implementation and commercial phases were slightly less affected. The impact of regulatory changes on all three stages of the business model lifecycle was low compared with other factors. However, the framework does not illustrate the business model design and the interrelations between external drivers and business model components.[174]

Cavalcante et al. also discussed the need for business model dynamization and developed a process-based conceptualization that takes different business model changes into account.[175] The framework displays possible incidents of business model change in new ventures and established company stages. Every change involved creating, adding, altering, or abandoning business processes. However, the model does not depict how changes impact business model design.[176]

[170] Morris et al. 2005, 733.
[171] Voelpel et al. 2004, 270.
[172] Refer Voelpel et al. 2004, 270.
[173] de Reuver et al. 2009, 3.
[174] Refer to de Reuver et al. 2009, 2–10.
[175] Refer to Cavalcante et al. 2011, 1330–1331.
[176] For this paragraph refer to Cavalcante et al. 2011, 1330–1334.

Taken together, the literature shows that business model dynamics is a non-static approach with environmental interaction. Some concepts depict the actual business model configuration, as well as the mechanisms and consequences of business model change. Other concepts take different lifecycle stages – whether it be development or operative – into account. Several concepts describe a wheel[177] or cycle,[178] which ensures continuously recurring processes.

A dynamic business model approach comprises various recurring activities, i.e. design and change, that can take place simultaneously and are triggered by internal or external factors. Environmental factors, such as the user, not only affect the business model but also interact with it. Dynamic business model approaches consider these interdependencies and the impact they have on the business model. In summary, these findings indicate that dynamic business model approaches should:

(1) integrate design and change activities
(2) take the continuousness, interdependency, and simultaneousness of design and change processes into account.

3.2.2 Business model environment and internal factors

When it comes to developing a business model, the question of demand for the products or services being offered is inevitable. The demand in terms of user needs and behavioral changes, followed by the analysis of the supply-sided markets, competitors, and industries should be examined early on, when the business model is taking shape.[179] If changes in the corporate environment pose a threat to the existing business model, companies are forced to overhaul their business model. Changing external factors like social or technological innovations as well as ecological, political, or legal evolutions shape the business model`s surroundings. The *external factors* that can affect the business model are defined as the **business model environment** (Figure 10).[180]

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[177] Refer to Voelpel et al. 2004, 270.
[178] For instance Morris et al. 2005, 733.
[179] Refer to Wirtz 2013, 242–245.
[180] Refer to Schallmo and Brecht 2010, 13.

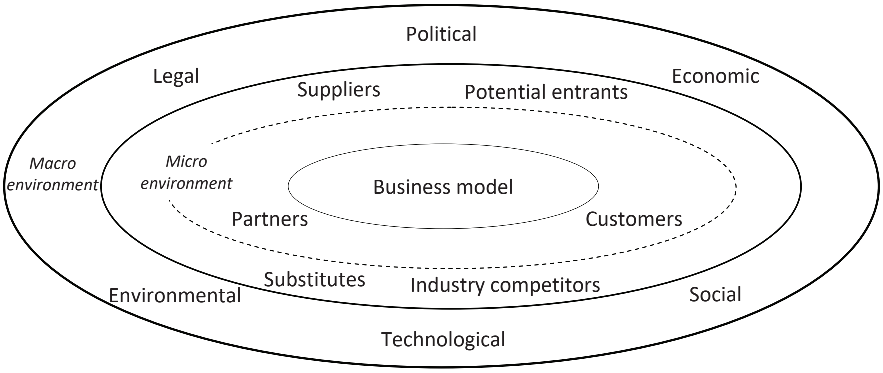

Figure 10: The business model environment.
Adapted from Schallmo and Brecht 2010, 13.

Although major changes are frequently caused by external factors (e.g. introduction of a new law), business models evolve constantly and this evolution is frequently triggered by *internal factors* that aim towards operational efficiency.[181] These internal factors are outcomes of middle to top management decisions as well as dynamics within or between business model components. The latter occurs once the business model is implemented. For instance, the learning curve for resource management can change the value creation component.[182] Stampfl investigated business model environments and their underlying external factors in an extensive literature review and explorative study. He stated that blurred industry boundaries and highly dynamic business environments create new perspectives. Business models change dynamically, and stability is no longer a guarantee for success. Moreover, business models are no longer solely affected by external factors, but interact bidirectionally with their environment.[183]

Stampfl summarized the factors which might affect a business model and can be monitored within the business model environment. He claimed that the user dimension and its underlying factors have a higher – and in some cases bidirectional – impact on the business model compared with, for instance, other market-related dimensions such as competitors. Among other factors like the power and role of users, brand relevance, and price elasticity, Stampfl stressed that real user needs must be identified within the busi-

[181] Refer to Saebi 2015, 150.
[182] Refer to Demil and Lecocq 2010, 236–237.
[183] Refer to Stampfl 2016, 197.

ness model environment to create a suitable value proposition and a successful business.[184]

3.2.3 Dynamic consistency

Developing and sustaining a **competitive advantage** is the cornerstone of strategic management.[185] A competitive advantage that is gained through firm resources can be imitated by other business models in many cases.[186] Intangible resources, such as processes, knowledge, or relationships as well as non-transparency due to interdependencies between resources foster a competitive advantage that is harder to imitate.[187]

Going beyond the resource-based view,[188] Pfau described the **fit approach** to staying competitive over time. This approach strives for equilibrium between internal performance potentials and external factors in an enterprise's environment. The fit mechanism is influenced by the changing environment, the firm's configuration of resources, and the touching points between the enterprise and its environment.[189] Hence, strategic management is required to thoroughly analyze the company's environment, its internal resources, and interdependencies between the two. This allows business strategy, objectives, and actions to be determined and implemented. Because of business dynamics – such as market dynamics, technological change, or globalization – Pfau has highlighted the need to continuously monitor internal and external factors and, if necessary, to adapt strategies to maintain equilibrium and sustain the fit.[190]

Demil and Lecocq took the concept of **dynamic capabilities** even further.[191] They described a business model to be in a permanent "[…] state of transitory disequilibrium […]".[192] This disequilibrium is caused by the constantly changing environment and changing internal factors. Managers must acquire dynamic capabilities to continuously adapt the business model, even if the sequences of change are incremental and evolutionary in most cases.[193] In a transitory out-of-balance state, firms strive for **dynamic**

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[184] Refer to Stampfl 2016, 201–206.
[185] Refer to Porter 1985; Barney 1991; Peteraf 1993; Dyer and Singh 1998.
[186] Refer to Teece 2010, 179
[187] Refer to Teece 2010, 182
[188] See chapter 3.1.1.
[189] Refer to Pfau 2001, 5.
[190] Refer to Pfau 2001, 5–6.
[191] First mentioned by Teece et al. 1997; Eisenhardt and Martin 2000.
[192] Demil and Lecocq 2010, 240.
[193] Refer to Demil and Lecocq 2010, 239

consistency between the core elements of the business model, where the business model's configurational fit – and thus its effectiveness and performance – is in line with the external dynamics.[194]

Teece et al. referred to Leonard-Barton and defined dynamic capabilities as "[…] the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions."[195]

In general, dynamic capabilities reflect the firm's ability to (1) sense opportunities and threats, (2) seize opportunities, and (3) transform intangible and tangible company assets to stay competitive over time. Transformation can entail enhancing, combining, protecting, and reconfiguring resources.[196] The stronger the firm's dynamic capabilities, the faster and more cost-effectively a fit between internal resources and external environment can be reached.[197] This fit, i.e. the dynamic consistency in business models, develops and sustains a competitive advantage over time.[198]

From a static point of view, the **business model** is a tool within the range of dynamic capabilities employed to seize opportunities. Here, specific business model designs present different financial and organizational architectures and put business opportunities side by side.[199] Although it takes dynamic capabilities to design, refine, test, and implement business models, these capabilities, such as the ability to monitor the market and sense unmet user needs, enable business model innovation and management.[200] But from a dynamic perspective, Amit and Zott argued that when business model design is understood as a constant process, the design procedure itself can be viewed as a dynamic capability for sensing and seizing opportunities and transforming assets.[201]

Here, the interdependency of dynamic capabilities and the concept of business model dynamics come into focus. Business model dynamics refers to the dynamic perspective

194 Refer to Demil and Lecocq 2010, 241–242.
195 Teece et al. 1997, 516.
196 Refer to Teece 2007, 1319.
197 Refer to Teece 2018, 43
198 Refer to Demil and Lecocq 2010, 244; Amit and Zott 2015, 13–15; Juntunen 2017, 192–194; Teece 2018, 40.
199 Refer to Teece 2007, 1329–1332, 2010, 190–191, 2018, 46–48; Amit and Zott 2015, 5.
200 Refer to Teece 2018, 45–46.
201 Refer to Amit and Zott 2015, 5;11-15

of business models and the necessity to continuously assess and revise a business model in response to changing external and internal factors. If necessary, business model change should be initiated within an evolution to innovation continuum. This includes the design of the business model to reach dynamic consistency between its core components.[202] This constant process of assessing and redefining the business model is categorized as a dynamic capability, which in turn gives the business a competitive advantage.

3.2.4 Dynamics in business model design and change

3.2.4.1 The dynamic process view

In general, dynamic processes are characterized by (1) continuousness, (2) interdependency, and (3) simultaneousness.[203] The process view of business model design and change is centered around activities grouped into phases that (re)create and change a business model. Wirtz differentiates between **business model design** and redesign, where the latter focuses on altering existing business models rather than forming new ones.[204] In this dissertation, design and redesign are considered the same. Once a design is successfully accomplished, the business model depicts an enterprise's value creation logic at a specific point in time.[205] However, this static view of a business model does not consider actual developments within the business model environment. Minor or even disruptive business model changes may be indispensable to stay competitive over time.[206] Saebi defines **business model change** as "[…] the process by which management actively alters the intra-organizational and/or extra-organizational systems of activities and relations of the business model in response to changing environmental conditions."[207] Extending Saebi's definition, business model change can also be a reaction to shifts in internal – i.e. corporate-bound – factors.[208]

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[202] See chapter 3.2.1.1 for business model dynamics definition.
[203] See chapter 2.1 for dynamic approaches.
[204] Refer to Wirtz 2013, 234-235.
[205] See chapter 3.1.3 for statics in business model design.
[206] Refer to Osterwalder et al. 2005, 15–16; Cavalcante et al. 2011, 1328; Putten et al. 2012, 140.
[207] Saebi 2015, 148.
[208] Refer to Wirtz 2018, 253.

Business model dynamics emphasize the need to evaluate a business model constantly. The realization of a process that fosters business model dynamics must incorporate design and change activities.[209]

In the following, literature on business model design, change, and innovation processes is reviewed. The overview in Table 4 is not exhaustive, but effectively outlines recurring patterns in the configuration of business model design and change activities that are grouped into phases. The concepts in Table 4 follow either a linear or an iterative process model approach.[210] These concepts also include a graphical visualization of the processes they are describing. The literature review revealed only a few procedural descriptions geared towards business model design and change as separate processes,[211] but several concepts that incorporate activities of both.[212] Business model innovation processes also incorporate business model design as well as change activities, but they primarily consider innovation as the outer edge of the business model change continuum.

[209] See chapter 3.2.1 for business model dynamics.
[210] For an overview of meta-process model and their characteristics, see chapter 5.1.1.
[211] See Wirtz 2018, 265–321.
[212] See Amit and Zott 2015, 6.

	Change activities			Design activities				Implementation activities			Dynamic activities / process model type
Business model design processes											
Process of (Re)Designing the Business Model (Amit and Zott 2015)	Observing	Synthesizing		Generating	Refining			Implementing			- / linear process model
Business Model Design Process (adapted from Osterwalder and Pigneur 2010)	Understand			Design				Implement			Manage / linear process model
Business model design process (Wirtz 2018)				Ideation	Feasibility	Prototyping	Decision Making				
Business model change processes											
Business model change process (Balocco et al. 2019)	Identifying the strategic change needed							Preparing the company	Preparing the customers and testing	BM change execution	- / linear process model
Business model change process (Wirtz 2018)	Initiation		Concept					Implementation			Evaluation / linear process model
Process of business model change (Juntunen 2017)	Evaluation	Modified goals	Goal formulation					Implementation			- / iterative process model
Business model innovation processes											
The 4I-framework (Frankenberger et al. 2013a; Gassmann et al. 2017a)	Initiation			Ideation			Integration	Implementation			- / iterative process model
Business model innovation process (adapted from Wirtz 2018)	Analysis of initial situation			Idea generation	Feasibility study	Prototyping	Decision making	Implementation			Sustainability Securing / linear process model
Business model innovation (Schallmo 2013a)				BM ideation	BM vision	BM prototyping	BM design	BM implementation			BM extension / iterative process model

Table 4: Literature-based overview of business model design and change activities.

3.2.4.2 Business model change activities

As discussed above, this dissertation applies a dynamic process view. Business model design and change are continuous processes that can run simultaneously. Externalities, such as user needs, not only trigger change in an existing business model but also provide the basis for the innovation of a new business model.[213] The status quo of the business model design is a reference for potential changes. If no references (i.e. a business model) exist, the change produces a new business model (i.e. business model innovation).[214] Following this dynamic and market-based school of thought, no design activity will occur before a change activity takes place. Therefore, change activities are described first.

Figure 11 shows that business model change activities observe and analyze changing external factors within the business model environment as well as conceptualize changes to the business model.[215]

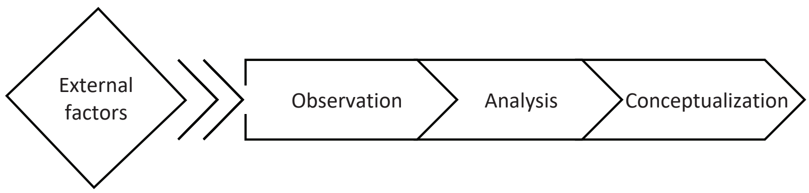

Figure 11: Business model change activities.

Business model change usually starts with an **observation** phase.[216] Changing external factors makes business model change necessary.[217] Osterwalder's and Pigneur's 'understand' phase highlights the activity of a profound market analysis to understand users and the business environment. Established companies should examine their existing business model and search for new market opportunities beyond the status quo.[218] Here, the main difference between innovation-oriented and change-focused approaches becomes obvious: innovation usually assumes the creation of a fairly new business model and aims to understand the business model environment. Change con-

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[213] Refer to Stampfl 2016, 197.
[214] Refer to Osterwalder and Pigneur 2010, 252–253.
[215] See chapter 3.2.2 for details on internal and external factors.
[216] Some concepts call this phase 'initiation'. But the term 'observation' draws a rather direct link to the actual, executed activity.
[217] Refer to Wirtz et al. 2016, 253, 320; Wirtz 2018, 41.
[218] Refer to Osterwalder and Pigneur 2010, 252–253.

cepts, on the other hand, focus on actual or anticipated changes within this environment. Logically, the ability to detect changes implies a fundamental overview of the status quo in the first place, even if this step is not depicted in the change activities. Some business model innovation concepts assign the analysis of the business model environment to design activities[219] or do not integrate change activities.[220] To pursue a long-term perspective and to detect external factors which might impact the business model, Osterwalder and Pigneur suggest continuously scanning the business model environment.[221] Scanning is a more intuitive approach to examine and roughly chapter the business model environment. The resulting collection and editing of unstructured data is time-consuming. On the other hand, monitoring is an in-depth and continuously running analysis which targets specific information.[222] According to Demil and Lecocq, managers must continuously monitor and analyze the firm's environment and internal developments to keep abreast of business model dynamics.[223]

Monitoring external changes entails **analysis** of the gathered information. Amit and Zott refer to this phase as 'synthesizing' and state that ordering, pattern identification, and sense-making are essential steps in analyzing collected data. The authors point out that the conclusive step of this phase is to identify the missing pieces – i.e. the required type of business model change.[224] Additionally, the status quo of the business model is the reference for analysis.[225] Monitored external changes (e.g. shift in user demands) within the business model environment are compared with the status quo of the business model (e.g. benefits of meeting user demands). This procedure indicates the type of business model change and gives ideas for necessary changes towards a future business model.[226]

Conceptualization is based on the results of the previous analysis. During this activity, necessary changes to business model components and their interdependencies are determined in detail. This phase creates a deeper understanding of the change's impact

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[219] For instance, Schallmo assigns the analysis of the business model environment to the design-related 'business model vision' phase of his process. Refer to Schallmo 2013a, 165–191.

[220] See Hamel 2001, 7.

[221] Refer to Osterwalder and Pigneur 2010, 258.

[222] Refer to Krystek and Müller-Stewens 1990, 350; Liebl 1996, 12.

[223] Refer to Demil and Lecocq 2010, 241

[224] Refer to Amit and Zott 2015, 7–8. See also chapter 3.1.3, Table 3.

[225] Refer to Gassmann et al. 2017b, 28–30.

[226] Refer to Demil and Lecocq 2010, 241; Osterwalder and Pigneur 2010, 253; Wirtz 2018, 320.

on the business model. Depending on how many components are affected by these changes, the business model configuration might be adapted or radically innovated.[227]

3.2.4.3 Business model design activities

With regard to the processes described in Table 4, **business model design activities** usually involve ideation, prototyping, and integration (Figure 12).

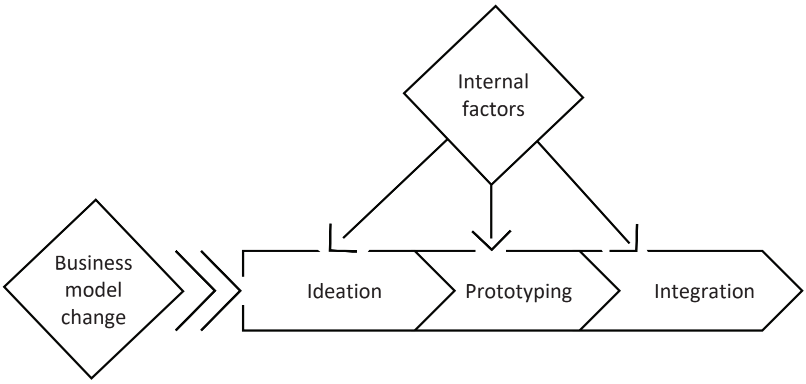

Figure 12: Business model design activities.

The **ideation** phase of the design process identifies and collects potential gaps and ideas by market analysis and creativity techniques (e.g. morphological box[228]).[229] Furthermore, it can determine a strategic direction, i.e. imitation vs. innovation, of business model design.[230] The ideation phase can result in an initial concept which roughly depicts the business model's components and must be in line with external factors (e.g. user needs).[231] Amit and Zott drew attention to the fact that not every design project means to create a business model from scratch; sometimes the objective may be to design modifications for an existing business model. Therefore, the business model components might be beyond an initial concept in terms of detailing.[232] A number of authors also suggested further analysis of user- and market-related business model com-

[227] Refer to Demil and Lecocq 2010, 241; Juntunen 2017, 82–83; Wirtz 2018, 322.

[228] Besides the morphological box, literature provides a variety of business model ideation and creativity techniques. Exhaustive overviews can be found in Schallmo 2013a, 157–164; Mezger 2018, 110–117; Wirtz 2018, 267–270.

[229] Refer to Schallmo 2013a, 157–164; Wirtz 2018, 265–266.

[230] Refer Wirtz 2018, 266.

[231] Refer to Frankenberger et al. 2013a, 265–267.

[232] Refer to Amit and Zott 2015, 8.

ponents to guarantee feasibility,[233] for instance, environmental analysis geared towards technological, regulatory, economic, and social specialties and issues in the business model environment. Industry and market analysis addresses market structures, consumer behavior, and existing industries and aims for a comprehensive overview of market size, potential, and saturation. This step identifies the overall prospects for success in an existing or new market. In the case of an existing industry, a competitive analysis such as Porter's Five Forces model[234] can further test the prospective business model's feasibility.[235]

Prototyping is a crucial step in business model design since testing different business model prototypes or business model alternatives detects configurational misfits[236] among business model components before the model is implemented. Prototyping requires detailed business model components and overall ontologies. These elaborate business models are further refined and evaluated during prototyping.[237] Osterwalder and Pigneur stated that business model prototyping pre-implements, visualizes, tests, and – in the manner of design attitude – inquires and dismisses multiple crucial design possibilities before choosing those for further refinement.[238] Moreover, the authors presented four business model prototypes at different scales: the napkin sketch, elaborated ontology, business case, and field test. The napkin sketch prototype involves an initial business model configuration including the value proposition and main revenue streams. The elaborated ontology prototype includes all relevant business model components and underlying elements as well as the relationships between these elements. The business case prototype enriches the business model ontology with data on costs and revenues and allows one to run financial scenarios. Finally, the field test prototype brings a business model prototype to the market and examines user acceptance and

[233] Refer to Schallmo 2013a, 164–180; Amit and Zott 2015, 9; Wirtz 2018, 270–275.

[234] Refer to Porter 1980.

[235] Refer to Wirtz 2018, 270–276.

[236] A configurational misfit points towards the misalignment of business model components or underlying elements and hinders the model's effectiveness. Refer to Magretta 2002, 6; Nenonen and Storbacka 2010, 51–52; Kindström and Kowalkowski 2015, 10.

[237] Refer to Osterwalder and Pigneur 2010, 254–255; Amit and Zott 2015, 9–10; Wirtz 2018, 274–275. Schallmo provides an exhaustive review of business model prototyping from design to extension and evaluation of prototypes. Refer to Schallmo 2013a, 190–204. Gassmann et al. are the only authors to assign the prototyping phase to implementation activities. Refer to Gassmann et al. 2017b, 66–69.

[238] Refer to Osterwalder and Pigneur 2010, 164–165.

feasibility. Prospective or actual users test and give feedback on the field-testable business model's components in a real environment – the marketplace.[239]

Business model design concludes with an **integration** phase. This refines business model components, compares remaining business model options, and selects a business model alternative.[240] During integration, an elaborated business model ontology is determined, and its components and underlying elements are specified, visually represented, and registered.[241] When detailing the business model components, designers must aim for consistency between components.[242] A final refined business model alternative whose components are aligned completes a successful design process.

Implementation activities are not within the scope of this dissertation. However, the implementation of a tested business model design is crucial for building organizational capabilities and resources to successfully realize the chosen business model design.[243] Implementation activities can also be supported through testing, for example with user feedback.[244]

3.2.4.4 Dynamic business model design and change framework

According to the findings in chapter 2.1, **dynamic activities** are tasks that enable interdependency between process phases and underlying steps as well as a continuous evaluation and – if needed – adaptation of the business model. **Iterative process models** are continuous and can provide interdependency or simultaneousness between phases and activities. **Linear process models** do not involve iterations, so do not bring continuousness, interdependency, or simultaneousness to phases and activities.[245]

Osterwalder and Pigneur included a final 'management' phase at the end of their linear process. They suggested tasks to proactively monitor the environment, detect changes, and modify the business model. Although this phase describes the need for continuous business model management, it lacks a graphical visualization of recurring activities

[239] Refer to Osterwalder and Pigneur 2010, 165.
[240] Refer to Osterwalder and Pigneur 2010, 254–255; Wirtz 2018, 240–279.
[241] Refer to Schallmo 2013a, 148
[242] Refer to Frankenberger et al. 2013a, 265–267.
[243] Refer to Amit and Zott 2015, 10.
[244] For instance, Balocco et al. prepare the company for the business model change in a first step before testing the newly implemented business model with its targeted customers. Refer to Balocco et al. 2019, 1531–1533.
[245] Overview of meta-process model types and their features see chapter 5.1.1.

since it is the last phase of a linear process.[246] Wirtz implemented the final 'evaluation' phase in the change process of his linear business model, and suggested that further business model adaptations as a result of controlling activities are optional. Here, too, the linear model does not graphically depict process continuousness.[247] Schallmo's 'business model extension' phase is similar to Wirtz's 'sustainability securing' phase. Both business model innovation processes aim for business growth through business model adaptations. However, Wirtz's linear model is completed at a certain point and is not continuous. Schallmo narrows the type of change down to business model extension, but installs iteration loops in his model to graphically depict continuous business model growth.[248] Amit and Zott as well as Juntunen arranged change, design, and implementation into their iterative process model (circular shape) to enable a continuous process flow.[249] Balocco et al. chose an iteration loop after the second implementation phase of their process diagram to secure a continuous change process until the user feedback is positive and the final business model is executed.[250]

Frankenberger et al. and Gassman et al. defined an iterative process model that enabled interdependency between all process phases and activities as well as a continuous process flow until the final business model is launched in the market (Figure 13).[251]

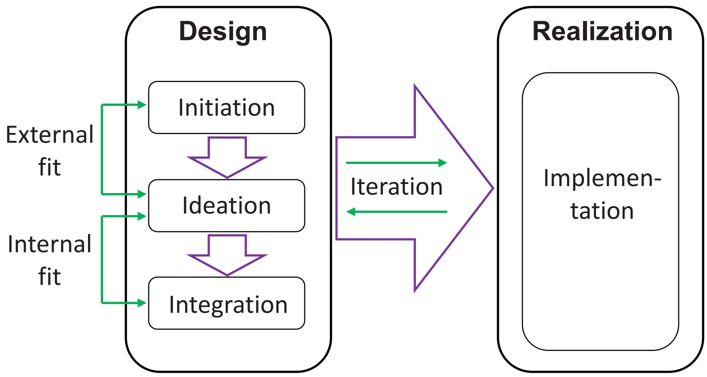

Figure 13: Dynamics in 4I framework.
Adapted from Gassmann et al. 2017b, 65.

[246] Refer to Osterwalder and Pigneur 2010, 258–259.
[247] Refer to Wirtz 2018, 321–322.
[248] Refer to Schallmo 2013a, 152–155; Wirtz 2018, 241.
[249] Refer to Amit and Zott 2015, 6; Juntunen 2017, 81.
[250] Refer to Balocco et al. 2019, 1531.
[251] Refer to Frankenberger et al. 2013a, 266; Gassmann et al. 2017b, 22.

The authors predetermined the sequence of activities (purple arrows) but also enabled interdependent iterations (green arrows). Nevertheless, the process flow marked in purple implies that design activities must be completed before realization begins. Internal or external changes are not an ongoing monitoring process, but rather an object of analysis within the initiation phase. Here, observing the business model environment depicts a specific point in time, and the design is based on this information. Changes during the design phase are neither observed nor deployed for design adaptation. However, the authors also point out the importance of an internal and external fit before launching the business model. This also means going back to the initial design through iteration loops if business model testing does not give the expected results.[252]

According to the authors, this **trial-and-error approach** masters the complexity of business model innovation. The framework's iteration loops – i.e. going back and forth between design and realization phase as well as pilots, trials, and prototypes of the business model – guarantee both an external and internal fit of the new business model. The internal fit aims for consistency between the business model components, whereas the external fit aims to align the business model with its environment.[253] This is the same as the dynamic consistency approach by Demil and Lecocq, which is an essential part of business model dynamics logic (as described in chapter 3.2.1.1).[254] The 4I (Initiation, Ideation, Integration, Implementation) framework meets the requirements of a dynamic business model by providing interdependency between phases (internal and external fit) and continuous iteration loops until the final business model is launched (Figure 13). Nevertheless, none of the examined approaches meet all three criteria of dynamic processes: continuousness, interdependency, and simultaneousness.

The previous discussion and definition of business model dynamics[255] show that continuous interdependency between change and design activities ensure dynamic consistency. Figure 14 illustrates the dynamics of external factors, business model change, business model design, and the impact of internal factors. The elements are interdependent, and the outcome of one element can impact another. Changing external factors might induce business model change, which might alter the business model design and internal factors. For instance, when user needs change, managers feel compelled

[252] Refer to Frankenberger et al. 2013a, 265–268; Gassmann et al. 2017b, 60–63
[253] Refer to Frankenberger et al. 2013a, 265–266; Gassmann et al. 2017b, 66–69
[254] Refer to Demil and Lecocq 2010, 241–242.
[255] See chapter 3.2.1.1 for business model dynamics definition.

to change the business model accordingly. The status quo of the business model design is a reference for potential changes. Business model change conceptualization is the output of business model change activities. These recommendations for business model change help to design the business model. In turn, the new business model design might prompt change in internal operations or resources.

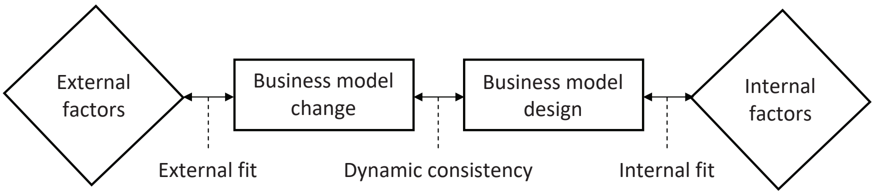

Figure 14: Business model change and design dynamics framework.

Internal factors may also change the business model design. The new design might trigger business model change if the external fit and herewith dynamic consistency cannot be reached. For example, a management decision on budget cutbacks leads to lower quality production of the market offering. This alters the value proposition (e.g. specifications of the offering, benefits to the user) and value creation and distribution (e.g. resources and revenue streams). The new business model is then tested in the market. As an example, a quality-seeking user segment may then feel its needs are no longer addressed by the new offering. The external fit is out of balance and a business model change might be initiated that adapts user segments within the business model design.

Taking business model dynamics and dynamic approaches into account,[256] Figure 14 illustrates the logic of a dynamic business model approach, without detail and without a user-centric perspective. The illustration clarifies the interdependencies between processes and indicates continuous iterations, but does not show process simultaneousness or simultaneous design and change (e.g. simultaneousness of ideation and observation). In the following chapters, both a user-centric view and a graphical conceptualization are needed to visualize the continuousness, interdependency, and simultaneousness of dynamic business model design and change processes.

[256] See chapters 2.1 and 3.2.1.1 for dynamic approaches and business model dynamics.

3.3 User-centric perspective of business models

The user-centric view of business models is clearly linked to the business model environment where the user acts as an external factor.[257] Aiming for a user-centric business model perspective, the following chapters examine theoretical approaches and concepts that take into account both enabling and constituting factors for user-centric approaches as well as a user-centric configuration of business models and its underlying components and elements.

3.3.1 Solution theory

A user-centric solution offers several links to the value proposition of a business model. Solutions are user-centric offerings that can be integrated into business model theory to create a user-centric value proposition.[258]

3.3.1.1 Solution concept: evolution and reference points in the management and marketing literature

The term ‘solution’ emerged from the manufacturing industry of the 1990s, when a shift in business strategy focused on selling integrated solutions instead of single products and services.[259] The concept began even earlier in the **customer centricity** school of thought, and was coined by Theodore Levitt in his ‘Marketing Myopia’ article in 1960.[260] Levitt claims that the absence of market growth is a “[…] failure of management […]”[261] which holds onto a product-oriented instead of a customer-oriented strategy.[262] In the case of the railroad industry, Levitt assumed that “They let others take customers away from them because they assumed themselves to be in the railroad business rather than in the transportation business.”[263]

Customer centricity has evolved into a holistic management approach[264] of which **customer integration** is a main component.[265] The origin and description of this concept

[257] See chapter 3.2.2 for a description of the business model environment.
[258] The synopsis of theories is described in chapter 4.
[259] Refer to Wise and Baumgartner 1999; Davies et al. 2001; Foote et al. 2001; Galbraith 2002.
[260] Refer to Levitt 2004; Lamberti 2013, 597.
[261] Levitt 2004, 138.
[262] Refer to Levitt 2004, 138–139.
[263] Levitt 2004, 138.
[264] See chapter 2.3 for user-centric approaches.
[265] Refer to Stauss and Bruhn 2009, 5; Lamberti 2013, 596–597.

can be assigned to different periods, geographical areas, and academic movements.[266] Kleinaltenkamp et al. concluded that customer integration basically describes the customer's contribution in the form of information, work, or tangible factors in producing goods and services.[267]

Awareness of user needs and preferences has increased in marketing and management. In 1983, more than two decades after his aforementioned indicatory article, Theodore Levitt popularized the Leo McGinneva quote: "People don't want to buy a quarter-inch drill, they want a quarter-inch hole."[268] Levitt brings in a new perspective of consumer's seeking solutions to a problem rather than "[…] problem-solving tools […]"[269] that "[…] fulfill a problem-solving need […]"[270]. By this time, traditional manufacturers were dealing with a demand-driven shift in strategy and facing up to the idea of **servitization**, a concept first introduced by Vandermerwe and Rada in 1988.[271] A firm's core offering gains value and competitiveness by services, knowledge, support, and self-service. Since a large share of these bundles (and with that, the inherent added value) goes into services, servitization is at the top of the management agenda. The transition to servitization includes the establishment and maintenance of closer relationships with users as they expect direct assistance as well as the opportunity to customize offerings themselves.[272]

In 2004, Vargo and Lusch introduced a new idea in marketing: the **service-dominant logic**. They argued that focus is no longer on tangible outputs or *operand resources*, such as goods, capital, and static resources, but on intangible factors or *operant resources*, such as exchange processes, knowledge, skills, information, and relationships.[273] The authors also make a great distinction between the meaning of *service* in goods-dominant as opposed to service-dominant logic; the latter defines service as a value-creating, dynamic resource that comes in the form of knowledge and skills, while goods-dominant logic sees services as output units that are inferior to goods. Vargo and

[266] In the German-speaking world, Engelhardt was the first to introduce the concept of customer integration in 1966, whereas the English-speaking world shows a highly differentiated history of concepts beginning in the 1980s. Refer to Engelhardt 1966; Kleinaltenkamp et al. 2009, 37–44.

[267] Refer to Kleinaltenkamp et al. 2009, 38–44; Stauss and Bruhn 2009, 10.

[268] Levitt 1983, 128.

[269] Levitt 1983, 76.

[270] Levitt 1983, 76.

[271] Refer to Vandermerwe and Rada 1988, 314.

[272] Refer to Vandermerwe and Rada 1988, 314–324; Baines et al. 2009, 347–348.

[273] Refer to Vargo and Lusch 2004, 2.

Lusch stated that goods are "[…] conveyors of competences […]"[274] or "[…] service-delivery vehicles […]"[275], because the provider's skills and knowledge (service) create value, which goods merely convey at times.[276] Furthermore, they stress the importance of the relational processes of exchange between providers and users, and not just transactions of things.[277] The user and all other parties involved are co-creators and beneficiaries of the value proposed through market offerings (value proposition). In terms of service-dominant logic, value comes from the process of use, i.e. *value in use*, e.g. the manufactured car combined with the user's driving skills and the public's roadways.[278]

Vargo and Lusch summarized that *features* or *attributes* belong to goods-dominant logic, whereas *solutions* are characterized by service-dominant logic. *Benefits* is mostly used in transitional marketing concepts, i.e. concepts that were developed between goods-dominant and service-dominant logic.[279] Ahlert et al. also concluded that solution marketing originally developed from service-dominant logic.[280]

3.3.1.2 Solution specifications: constituting features and differentiation from other approaches

Management and marketing have shifted over the last sixty years towards the user and their preferences and needs. Beginning with a user-centric rather than product-centric view, manufacturers have been turning away from resource-driven product differentiation strategies and focusing more on market-driven *user problems* and ways to solve them.[281]

Nevertheless, several solution-oriented concepts use a core product as the nucleus of investigation and add value by adding services.[282] Levitt was the first to introduce a so-

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[274] Vargo and Lusch 2008, 256.
[275] Vargo et al. 2008, 148.
[276] Refer to Vargo and Lusch 2006, 283, 2008, 256; Vargo et al. 2008, 148.
[277] Refer to Vargo and Lusch 2004, 15.
[278] Refer to Vargo et al. 2008, 148.
[279] Refer to Vargo and Lusch 2004, 2006; Vargo et al. 2008, 148.
[280] Refer to Ahlert et al. 2008, 29.
[281] See chapter 3.3.1.1 for the evolution of the solution concept; see also Shepherd and Ahmed 2000; Sheridan and Bullinger 2001; Stremersch et al. 2001; Galbraith 2002.
[282] Referring to concepts that are operationalized by a circle- or shell-like structure with a product kernel, e.g. 'The total product concept' by Levitt 1980, 'Leistungssystem' by Belz 1997, 'The extended product' by Thoben et al. 2001.

lution business-related approach: the *total product concept*.[283] More than two decades later, Thoben et al. developed the *extended product concept*, which is similar to Levitt's idea in terms of the applied *ring model* logic (Figure 15, A).[284]

Both conceptions describe the generic or the core product as the foundation of business. Although this appears to be an all-tangible product, both authors clarify that an intangible core (based, for example, on information or knowledge) is possible.[285] Within Levitt's concept (Figure 15, A), the user's perspective is important. The expected product circle (inner ring) reflects the minimal expectations of the customer in terms of purchase conditions (e.g. delivery, terms, support); the absence of these minimal requirements will negatively affect the overall attraction towards the generic core product. Beyond that, certain features and services are related to the generic product, which the user does not expect and, when applied, transform it into an augmented product (second ring, e.g. training). The last circle describes the potential product with all the possible action and information needed to alter the product and improve customer acquisition or loyalty (third ring, e.g. potential technical modifications, market research findings).[286] In comparison, the extended product concept introduced by Thoben et al. characterizes the first ring as the product shell, which is of a physical nature (e.g. packaging) and encompasses all attributes of the core product (e.g. materials and technical functions) as a tangible entity. The second, non-intangible ring includes services that transform the product into a solution consisting of tangible and intangible components.[287]

These concepts clearly highlight the need for *product-service combinations*, where products are complemented by services to add value by differentiating the core product. Other approaches aim to create value by *integrating* these components into a new solution; the surplus value is generated through integration and the final solution has more value than its parts (Figure 15).[288]

[283] Refer to Levitt 1980.

[284] Refer to Thoben et al. 2001.

[285] Refer to Levitt 1980, 85; Thoben et al. 2001, 437; Eschenbächer et al. 2011, 300. In one of the latest published texts on the extended product concept, Wiesner et al. refine the concept in terms of the product's interoperability, but no longer cover the case of an entirely intangible core product (first ring). Refer to Wiesner et al. 2013, 306–307.

[286] Refer to Levitt 1980, 85–88.

[287] Refer to Thoben et al. 2001, 436–437; Eschenbächer et al. 2011, 299–300.

[288] Refer to Vandermerwe and Rada 1988, 315–317; Davies et al. 2001, 7; Sawhney 2006, 8; Pawar et al. 2009, 474–475.

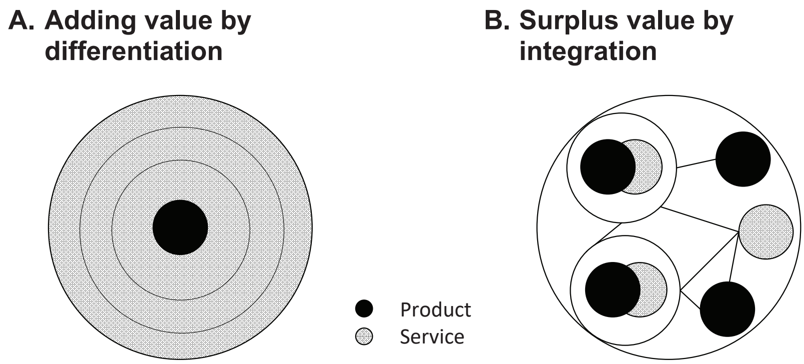

Figure 15: From differentiation to integration – the evolution of product-service combinations. Adapted from Meier et al. 2011, 1178; Meier and Uhlmann 2012, 4.

In 2005, Meier et al. introduced the *hybrid offering concept* (Figure 15, B).[289] The hybrid system incorporates the idea of integrated and interacting proportions of products and services that generate *surplus value*. The authors claim that value-adding approaches (Figure 15, A) follow autarkic development processes where products and services are engineered independently. In contrast, hybrid offerings are planned and developed jointly. Besides, these offerings are provided by a collaborative network including provider, suppliers, and users.[290]

With reference to the abovementioned user-centricity school of thought, many authors also claim that a solution should offer *customizability*; i.e. the components should be combined and individualized to the user's needs.[291]

Beyond these constitutive solution characteristics, a second perspective in solution definition has been described. Thuli et al. identified a difference between the provider's and the user's view of solutions. Whereas providers tend to define solutions from a rather product-centric point of view (i.e. the combination of integrated products and services customized with regard to user needs), the user perceives solutions as strongly linked to a *relational process* between provider and users (Figure 16).[292]

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[289] Refer to Meier et al. 2005.
[290] Refer to Meier and Uhlmann 2012, 4–6.
[291] Refer to Hax and Wilde II 1999, 13; Foote et al. 2001, 92; Miller et al. 2002, 3; Sawhney 2006, 9–10.
[292] Refer to Tuli et al. 2007, 2; Evanschitzky et al. 2011, 657.

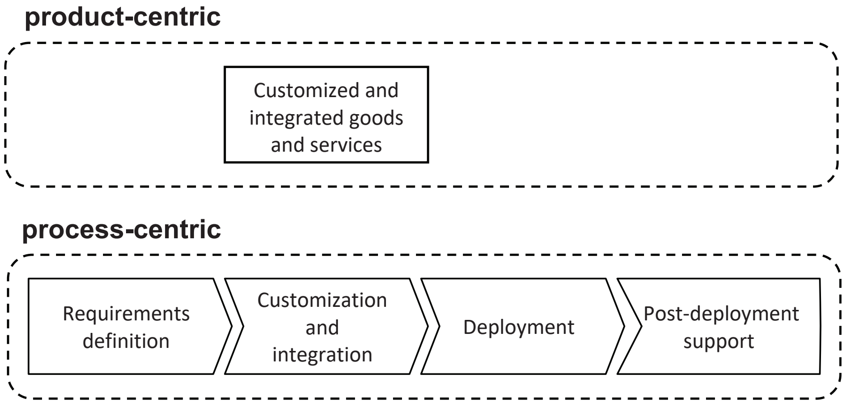

Figure 16: Product-centric versus process-centric view of user solutions.
Adapted from Tuli et al. 2007, 5.

Since the user is not always aware of their needs or has difficulties expressing them, from a process-centric perspective it is crucial to gather as much information from the user as possible within a strong business relationship. In doing so, it is important to keep track of user need development to consider potential solutions and adaptations. Based on this, requirements can be defined, and necessary alterations anticipated. The next step defines which components should be offered within the solution, particularly regarding user needs (customization) and the fit between elements (integration). Deployment is not only about delivering the solution but also about installing it into the user's environment as well as follow-up information and training. Post-deployment support clearly exceeds standard after-sales activities (spare parts, maintenance) and emphasizes – in line with the service-dominant logic by Vargo and Lusch[293] – the importance of an ongoing relational process between provider and user to guarantee the supply of an up-to-date customized and integrated solution.[294]

Tuli et al. concluded that a functional solution must comprise both customized and integrated product service combinations as well as relational processes between provider and user (requirement definition, deployment, and post-deployment support).[295]

[293] Refer to Vargo and Lusch 2004, 2006, 2011.

[294] Refer to Tuli et al. 2007, 5–8. In an article published in 2011, Meier et al. use the term 'industrial product-service systems' instead of hybrid offerings. Refer to Meier et al. 2011.

[295] Refer to Tuli et al. 2007, 13; further research on provider/consumer relationships in servitized or solution environments can be found, for example, in the works of Windahl and Lakemond 2006; Penttinen and Palmer 2007; Saccani et al. 2014.

Ahlert and Kawohl defined four significant solution characteristics: (1) individuality in the selection and adaptation of components that meet user needs, (2) integration by combining products/services/knowledge to generate surplus value, (3) relational communication and interaction between user and provider, (4) complexity arising from the combination of various components.[296] Burianek et al. also pointed out that hybrid offerings are determined by their complexity, which is in turn made up of variables such as the type of user benefit (product-oriented vs. result-oriented), the number of components integrated, or the level of customization.[297]

To subsume these attributes into a working definition of solutions, several imprecisions and pending questions must be addressed. As the solution initially arises from the manufacturing industry and is most frequently discussed in corresponding journals (e.g. *Industrial Marketing Management*),[298] the question arises whether the concept is also applicable to the business of service providers and if it is useful in a business-to-consumer (B2C) context. Must a solution serve as a package of fully integrated components that can't be sold independently, or must it be assembled as a modular concept? Has a specific solution been designed for one user exclusively or for a set of users?

Although solutions are regularly sold to business markets only, Nordin and Kowalkowski have stated that "[…] the dichotomy between business and consumer marketing is often artificial."[299] They described the approach to selling solutions to businesses as well as end users as more comprehensive.[300] Heikkilä and Brax discussed the case of a payment solutions provider to illustrate the implementation of solutions in service firms. The enterprise's solution nucleus was a payment service augmented with add-on services such as monitoring, reporting, and security.[301] The authors referred to Mathieu's definition of servitization and described the payment provider's solution model as 'product services' (i.e. services that are designed and built around an intangible or tangible core product and cannot be offered separately; compare with Figure 15). In contrast, 'service as a product' describes an offering that can be sold independently without the customer purchasing a tangible product.[302] In summary, solutions are feasible for solving end-

[296] Refer to Ahlert and Kawohl 2008, 12–14.
[297] Refer to Burianek et al. 2007, 10–12.
[298] Refer to Evanschitzky et al. 2011, 657; Hakanen and Jaakkola 2012, 594.
[299] Nordin and Kowalkowski 2010, 452.
[300] Refer to Nordin and Kowalkowski 2010, 452.
[301] Refer to Heikkilä and Brax 2009, 5–6.
[302] Refer to Mathieu 2001, 452–454; Heikkilä and Brax 2009, 2.

user problems and can be implemented in service-provider businesses, whereas the solution itself does not have to incorporate tangible components.[303]

Regardless of whether a solution is designed within the context of the service or manufacturing industry, it needs to be customized and integrated to meet user needs and to create surplus value. On the other hand, cost-effectiveness should also be considered. Windahl et al. explained that an individualized solution should "[…] be combined with well-defined modular structures to achieve economies of scale at the component level."[304] But according to Kawohl, strict modularity and autonomy of single components are constitutive characteristics of bundling and system selling.[305] Thus, customization and integration vary inversely to the degree of modularity. The final ratio of customization, integration, and modularity is also related to the number of potential users that should be targeted by one solution. Whereas Kawohl claims that, in contrast to bundling approaches, a solution is solely designed for a single user,[306] several authors define solutions as dedicated to "[…] a set of customers […]"[307] or "[…] specific clients or types of clients […]"[308].The higher the level of integration and customization, the lower the degree of modularity and the greater the probability that the solution will target the needs of a specific user. If a provider wants to attract a whole user segment with similar needs, and be cost-effective, then the solution has to be less integrated and more modularized.

Taken together, eight solution attributes have been described in the literature. A solution should:

(1) solve **user problems.**
(2) For this purpose, a **customized**,
(3) **integrated**,
(4) **modularized**
(5) **combination of products and/or services**
(6) should create **surplus value**

[303] Davies et al. also point out that solutions are important in the service provider sector, but literature mostly concentrates on the service-oriented downstream activities of the manufacturing industry. The authors refer to few articles which take the service provider perspective into consideration, such as Davies 2004. Refer to Davies et al. 2006, 41.

[304] Windahl et al. 2004, 227.

[305] Refer to Kawohl 2010, 52–58.

[306] Refer to Kawohl 2010, 57.

[307] Sawhney 2006, 8.

[308] Miller et al. 2002, 3.

(7) for an **individual user or set of users**.
(8) The solution is linked to a continuous **relational process** between provider and user.

3.3.1.3 Creating solutions: user-centric market segmentation

Market segmentation is a market-oriented approach in contrast to product differentiation. To develop a more **user-centric approach** to market segmentation, marketers investigated methods which offer an alternative to traditional segmentation criteria such as geographical factors, demographic factors, and volume of consumption factors.[309]

In 1968, Russell Haley introduced **benefit segmentation.**[310] According to Haley, the above-mentioned, rather descriptive factors merely allow ex-post factor analysis to describe the kinds of users that build different segments. He claims these approaches have no reliable power to predict customers' buying behavior. His benefit segmentation model is based on causal factors that he describes as the benefits a user perceives in consuming products.[311] Accordingly, people seek the same set of benefits form a market segment. Haley claims that "[…] benefits which people are seeking in consuming a given product are the basic reasons for the existence of true market segments […]"[312] and other criteria, such as demographic factors, are more likely to be post hoc in-depth descriptions of the derived market segments. However, user segments identified through benefit segmentation are generally not applicable to every type of product or service category because the benefits (e.g. 'decay prevention' or 'brightness of teeth' in the toothpaste market)[313] are largely product-tailored. Haley compared segment-forming benefits to the needs underlying this segment; in other words, he says that product design should target the needs of a specific user segment and gear towards combining the benefits this cluster is seeking.[314]

Botschen et al. claimed that Haley's benefit segmentation approach does not clearly distinguish between product attributes and underlying benefits, and therefore cannot predict the customer's purchasing behavior. They suggested the **means-end theory**, which was an adaptation of Haley's benefit segmentation method.[315] This theory was

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[309] Refer to Haley 1984, 5; Zafer 2015, 3.
[310] Haley first mentioned the benefit segmentation theory in his unpublished paper 'Experimental Research on Attitudes Toward Shampoos' from February 1961. Refer to Haley 1961, 1968, 31.
[311] Refer to Haley 1968, 31.
[312] Haley 1968, 31.
[313] Refer to Haley 1968, 33.
[314] Refer to Haley 1968, 34–35, 1984, 60, 1995, 6–7.
[315] Refer to Botschen et al. 1997, 39–40.

brought into focus by Gutman and Reynolds in the 1980s,[316] and “[…] is defined as consisting of an interconnected set of cognitive elements that allows a person to select objects or activities that enable him to achieve his desired end states.”[317] In other words, attributes of a product or service help users to achieve their desired consequences and values.[318]

Figure 17 illustrates the hierarchy of means-end chain elements. Botschen et al. argue that, from a user’s standpoint, concrete attributes like brightness-enhancing ingredients in a toothpaste do not matter. In the end, it is the offered solution to individual problems, such as the desire for a handsome appearance, that counts. The authors describe these functional and psycho-social consequences as the true benefit sought. For that reason, they suggest using the means-end chain method for benefit-based market segmentation.[319] This adapted benefit segmentation approach is clearly connected to the concept of solution-based offerings because it focuses on the user’s desires and wishes instead of on product-related attributes.

Levels of means-end chains	concrete attributes ▶	abstract attributes ▶	functional consequences ▶	psycho-social consequences ▶	instrumental values ▶	terminal values
Example *Toothpaste*	brightness-enhancing ingredients ▶	brightens teeth ▶	improves appearance ▶	feel attractive ▶	being center of attention ▶	self-esteem
Type of segmentation	*attribute-based (Haley 1968)*		*benefit-based (Botschen et al. 1997)*		*value-based*	

Figure 17: Applying means-end chain theory to market segmentation.
Adapted from Botschen et al. 1997, 42.

This link between product attributes, perceived benefits in use, and user needs was also thoroughly investigated by Tina Reichardt in 2008. She developed a customer **needs-oriented market segmentation** method for technological innovations. Reichardt analyzed the extensive theoretical background to distinguish between user needs, values, benefits, and product attributes. She concluded that needs can be translated into a lack of necessities which the individual is willing to eliminate. The individual value system,

[316] Refer to Gutman 1981, 1982; Reynolds and Gutman 1984, 1988.
[317] Gutman 1981, 116.
[318] Refer to Botschen et al. 1997, 40; Reichardt 2008, 78.
[319] Refer to Botschen et al. 1997, 40–45.

serving also as an item in the means-end chain, fundamentally co-determines the person's need pattern. However, Reichardt chose user needs for her market segmentation criteria since they are less complex and on a lower scale of abstraction. She also defined benefits as the perceived or fulfilled level of needs satisfaction, and pursued an approach analogous to that of Botschen et al. The higher the level of needs satisfaction, the better the attributes of the consumed product were matched to a person's needs. Reichardt concluded that the individual need pattern defines the type of benefits and the extent to which they will be received by consuming products.[320]

However, because data analytics and associated technologies have expanded, other types of user data (other than user needs) are available for market segmentation (Figure 18). These data include other profile data, such as sociodemographic data, habits, opinions, preferences, experiences, hobbies, and used devices/goods/infrastructures as well as real-time usage data (such as particular activities, location/time of usage and contextual/environmental information within the use process). Profile and usage data are combined into user profiles; real-time user demands and problems during use are also added to the pool of information.[321]

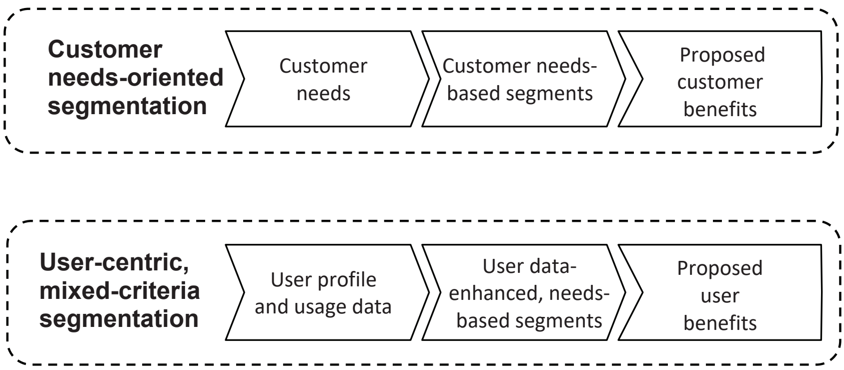

Figure 18: The potential development of market segmentation logic by data analytics.

In their empirical study of user-centric segmentation criteria, von Berg and Graff proved that differences in user-need patterns influence the willingness to use solutions the most.[322] By means of various regression analyses, relationships between particular user needs and the willingness to use mobility solutions was examined. On average, user

[320] Refer to Reichardt 2008, 80–81.
[321] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118.
[322] Refer to von Berg and Graff 2016, 46.

needs (e.g. comfort, data privacy, individuality) explained 20.2% of variance. Socio-demographic segmentation criteria (age, sex, occupation) explain 8.3%, on average, of the variance regarding the likelihood to use mobility solutions. Psychographic criteria (e.g. transportation preferences, technology, innovation affinity, ecological awareness) explain another 5.5% on average.[323] Because of practical constraints, the study could not consider real-time usage data.[324] Figure 18 illustrates the differences between a needs-oriented and a **user-centric, mixed-criteria segmentation** method. Both approaches pool user groups into segments with similar need patterns. In terms of a more holistic, user-centric approach, these segments are enhanced by gathering user-related data, such as socio-demographic, psychographic and behavioral criteria, that are gathered and analyzed by data analytics.

3.3.1.4 Delivering solutions: the behavioral customer model

Further developments in customer integration that are a constituting element of user-centric approaches have been reported in the literature.[325] Vargo and Lusch refined customer integration by transforming consumers into dynamic operant resources (e.g. knowledge, skills, competences) that activate operand resources (e.g. goods) to create value.[326] Weiber and Hörstrup broadened customer integration by considering digitalization and technological developments. Their **provider integration** concept is a management-oriented approach. It instructs enterprises in *service provision processes* that should be planned, coordinated, and controlled in sync with everyday life or consumer use processes. In this way, provider integration stresses the importance of *value in use*[327] rather than value of exchange, and markets utilization instead of products. Increased value of use coupled with user relationships and sustained marketing success must be the goal. The authors underline that traditional attempts to eliminate problems within the consumer's use process (e.g. through manuals, complaint management, and after-sales services) may implicitly increase the value in use, but they cannot monitor or influence these use processes in general.[328]

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[323] Refer to von Berg and Graff 2016, 46; von Berg and Randelhoff 2019.

[324] There were few multimodal solution providers in the market in 2015 and real-time data could not be gathered, so real-time usage data could not be collected.

[325] See chapters 2.3 for user-centric approaches and 3.3.1.1 for the evolution of the solution concept.

[326] Refer to Vargo and Lusch 2004, 7–12, 2006, 285; Vargo et al. 2008, 148.

[327] Refer to Vargo et al. 2008, 148.

[328] Refer to Weiber and Hörstrup 2009, 283–285; Weiber et al. 2011, 114–116.

The evolution of Ambient Intelligence (AmI)[329] or the Internet of Things (IoT)[330] has created an environment where the provider can monitor the consumer in their natural habitat, gather information from daily use processes, and intervene in these processes. This highly connected setting provides an opportunity to create smart services, such as telemetry-based car insurance where actual driving information influences the insurance rate.[331]

Figure 19 illustrates how provider integration functions within the **behavioral customer model**, whereas the process itself has a circular shape of continuous feedback loops. Value is formed during use (value in use) that consist of various activities; therefore, service provision must take place at the point of use, within the usage environment. Here, the provider acts as an external influencing factor that intervenes in the use processes. The AmI environment provides services in two different ways: either the user actively sends a real-time demand within the process of use which leads to a user-induced adaptation of the offered service (pull), or the provider gathers profile[332] and usage[333] data, combines them into user profiles, derives user demands, and ‘pushes’ a customized service to the user (push). Either way, the provider must match demands with the enterprise’s capabilities to map out the range of services that can be provided.

[329] “In an ambient intelligent environment, people are surrounded by networks of embedded intelligent devices that provide ubiquitous information, communication, services, and entertainment. Furthermore, the devices seamlessly adapt themselves to users and even anticipate their needs.”, Vasilakos and Pedrycz 2006, 1.

[330] “While there is no universal definition for the IoT, the core concept is that everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to achieve some useful objective.”, Whitmore et al. 2015, 261.

[331] Refer to Weiber and Hörstrup 2009, 285–286.

[332] Users’ characteristics (e.g. sociodemographic data, habits, opinions, desires/needs, preferences, experiences, hobbies) and environment (e.g. devices, goods, infrastructure). Refer to Weiber and Hörstrup 2009, 294–250; Weiber et al. 2011, 118.

[333] Real-time information throughout the consumer’s use process (e.g. current activity within the use process, data on consumer’s or device’s location, time of usage) which can be consolidated into usage histories and frequencies as well as number of activities and reactions from the customer over a period of time. Refer to Weiber and Hörstrup 2009, 294–250; Weiber et al. 2011, 118.

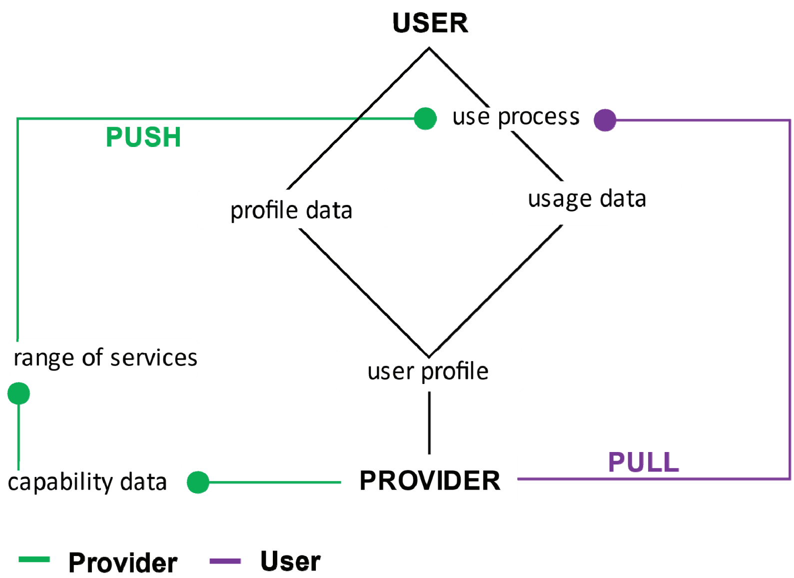

Figure 19: The behavioral customer model.
Adapted from Weiber and Hörstrup 2009, 293–295.

In contrast to the service-dominant logic of Vargo and Lusch, where the user is always a co-creator and an active operant resource in the process of service provision, the provider integration approach allows a passive user role (push). The user might permit the collection of their data and willingly use the pushed solution offering. Despite this rather passive user role, provider integration forces proactive customization of solution offerings and bidirectional interaction with users.[334]

3.3.2 Network theory

The user-centric value network concept has several points of contact with the value creation and distribution component of business models. Networks create and distribute value by means of their network partners, underlying roles, assets and transactions.[335] Value networks describe a user-centric type of networked value creation and distribution that can be integrated with business model theory.[336]

[334] Refer to Vargo and Lusch 2006, 285; Weiber et al. 2011, 115.
[335] Refer to Gomes-Casseres 2003, 328; Vanhaverbeke and Cloodt 2006, 259–274; Allee 2008, 9–14; Wirtz 2013, 97.
[336] The integration of theories is described in chapter 4.

3.3.2.1 Networks in business contexts

Network relations were initially discussed in the sociology/business science literature in 1937.[337] Within a business context, networks consist of relationships between or within independent enterprises as well as organizational units. This form of cooperation is the opposite of vertically or horizontally integrated companies.[338]

This raises the issue of where to assign **business networks** in terms of their economic organization. Williamson distinguishes between three generic organizational forms with divergent governance structures: market, hybrid, and hierarchy (firms).[339] Markets are coordinated by price and provide a framework for economic short-term activities between independent market participants. Hierarchy, i.e. behavior constraints, describe the long-term form of coordination within firms.[340] Whereas “Markets and hierarchies are polar modes […]”[341], hybrid modes describe “[…] various forms of long-term contracting, reciprocal trading, regulation, franchising, and the like – in relation to these polar modes.”[342] Hence, networks – with varying degrees of price and hierarchy control – are classed as hybrids. In the context of transaction cost theory, the organization with minimal transaction costs[343] should be chosen. Networks do not represent a discrete organization, but are a hybrid between market and firm.[344]

These networks – or disaggregated organizations–[345] emerge through diametrically opposed processes, as illustrated in Figure 20. The firm is structured by its hierarchical governance (Figure 20, a). Within the infusion of market governance into this hierarchy (quasi-externalization), a spin-off or outsourcing process takes place. Formerly hierarchically integrated business units become highly autonomous (e.g. profit center structures) and emerge into intra-organizational networks (Figure 20, c). Market governance provides essential structures for exchange deals and sales contracts (Figure 20, b). As

[337] Refer to Heußler 2011, 9.

[338] Refer to Sydow 2010b, 1.

[339] Refer to Williamson 1991, 269.

[340] Refer to Hennart 1993, 531; Ahlert et al. 2006, 78–79.

[341] Williamson 1991, 280.

[342] Williamson 1991, 280.

[343] Search and information costs, bargaining and decision costs, policing and enforcement costs. Refer to Dahlman 1979, 148.

[344] Refer to Hennart 1993, 545; Ahlert et al. 2006, 79–80. Ahlert et al. also state that other system-theoretical scholars classify networks as an independent form of organization next to market and firm. Refer to Ahlert et al. 2006, 78, Footnote 247.

[345] Refer to Zenger and Hesterly 1997, 212.

hierarchy infuses market exchange (quasi-internalization), autonomous firms intensify mutual market activities and cooperate in an inter-organizational network (Figure 20, d).[346]

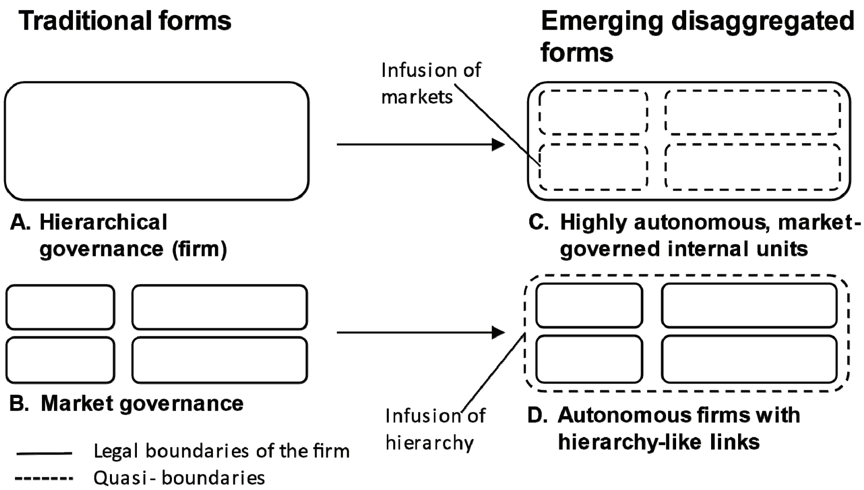

Figure 20: The transition from traditional to disaggregated forms between market and firm.
Adapted from Zenger and Hesterly 1997, 212.

Hierarchy costs (i.e. efforts in guidance and control of employees) involved in the transition from a to c can be reduced. In terms of the transition from b to d, intensified cooperative market activities between autonomous firms within increased hierarchy could reduce bargaining costs.[347]

Against this two-folded transition background, business networks are inter-organizational networks because they map out relations between firms. In contrast, intra-organizational networks describe relationships within the firm or its business units.[348] There are many inter-organizational network types, and Sydow has distinguished between two attributes: the type of organization (hierarchical/heterarchical) and its permanence (stable/dynamic).[349]

[346] Refer to Sydow 1992, 104–107, 2010a, 375–377; Zenger and Hesterly 1997, 211–213.
[347] Refer to Heußler 2011, 11.
[348] Refer to Ahlert et al. 2006, 76–78.
[349] Sydow provides a comprehensive overview of all network types and their distinctive features. Refer to Sydow 2003.

Figure 21 illustrates that project networks and strategic networks tend to be hierarchically organized. For instance, in the automotive industry, original equipment manufacturers administer strategic and long-term supplier networks in a strictly hierarchical manner.

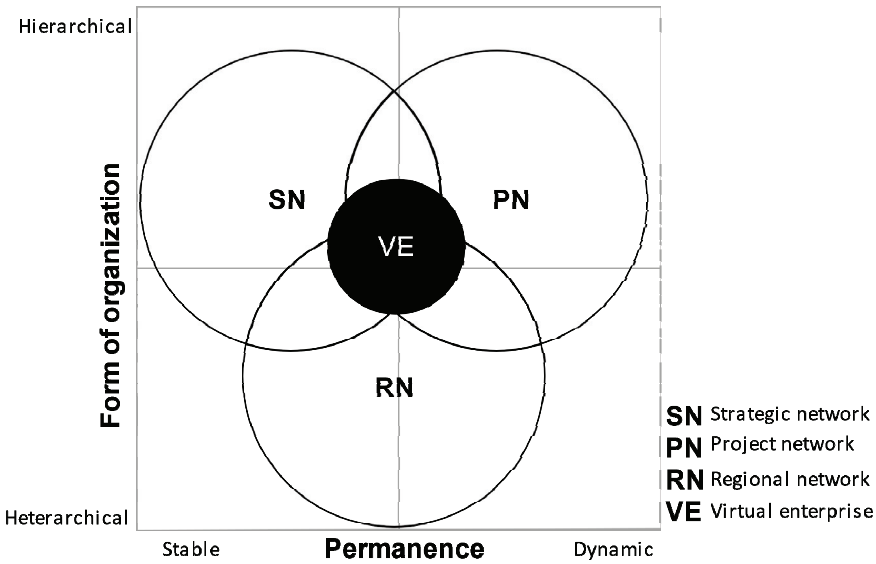

Figure 21: Inter-organizational network typology.
Adapted from Sydow 2010a, 382.

In contrast, regional networks are mostly characterized by heterarchical structures. Small and mid-sized independent companies cooperate within the frame of regional clusters. Through mid- to long-term cooperation agreements, regional networks aim for economies of scale or try to accelerate innovation efforts. In contrast to regional networks, project networks are built and dissolved dynamically as they tend to be temporary. However, virtual enterprises rely on IT systems to establish mainly heterarchical and temporarily dynamic project networks of several firms. Hence, virtual enterprises project the impression of an independent organization, but mostly avoid an institutional form of organization.[350]

In summary, business networks are defined as "[…] sets of connected relationships […]"[351] that form inter-organizational (i.e. inter-firm) networks. Business networks differ in their organizational structure and temporal permanence and can be supported by or solely exist through IT systems.

[350] Refer to Sydow 2010a, 379–386.
[351] Anderson et al. 1994, 1.

3.3.2.2 From value chain to value networks

Business network structures have also been analyzed in terms of their underlying value-creating architecture. In 1998, Stabell and Fjeldstad state that Porter's *value chain model*[352] cannot be used to analyze value-creating activities in several service industries.[353] In fact, the adaptation of Porter's five generic activity categories "[…] often obscures rather than illuminates the essence of value creation."[354] Porter's model illustrates value-adding activities on a firm level in chronological order. The framework facilitates the analysis of different activities in terms of their economic implications within a specific branch. The model's further development towards a *value systems* concept aims at a more interactive view of value creation by connecting different value chains into one system. However, the coupling of inter-organizational and cross-sector activities remains a linear process of adding value before passing inputs to the next actor in the chain. Both the value chain and the value system approach take a single-firm perspective.[355] In contrast to sequential value-adding models, value-creating networks were increasingly discussed in the 1990s. Allee defines these *value networks* as "[…] any purposeful group of people or organizations creating social and economic good through complex dynamic exchanges of tangible and intangible value."[356] Whereas tangible values encompass goods, services, and revenue, intangible values include knowledge and information (e.g. process knowledge, usage data) as well as other intangible benefits such as customer loyalty.[357]

Within the scope of strategic management literature, Dyer and Singh take a relational view on competitive advantage and argue – contrary to resource-based approaches – that critical assets and resources do not primarily lie within the firm's boundaries but within its networked relationships.[358] Norman and Ramirez pursued a similar approach of network-based value creation: *value constellation* "[…] where value occurs not in sequential chains, but in complex constellations […]"[359].

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[352] Refer to Porter 1985.
[353] Refer to Stabell and Fjeldstad 1998, 414.
[354] Stabell and Fjeldstad 1998, 414.
[355] Refer to Vanhaverbeke and Cloodt 2006, 265–266; Wirtz 2013, 201–203.
[356] Allee 2009, 429.
[357] Refer to Allee 2000, 37.
[358] Refer to Dyer and Singh 1998, 660–661.
[359] Norman and Ramirez 1993, 69.

Figure 22 illustrates the theoretical evolution from value-adding to value-creating models.

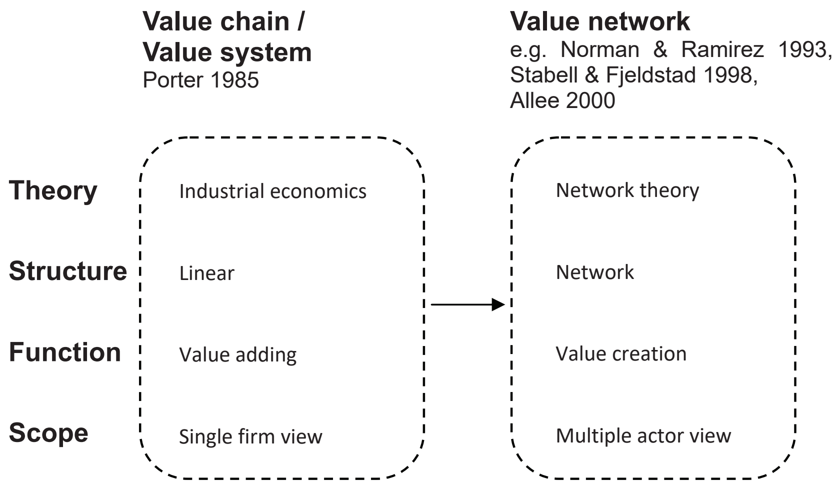

Figure 22: Evolution from value-adding to value-creating concepts.
Adapted from Wirtz 2013, 102.

Compared with Porter's value chain and value system model, value constellation is a network-based, non-linear value creation concept. From a multiple actor perspective, it focuses on the networked co-creation of an offering that competes with similar offerings in the market. Gomes-Casseres called this *collective competition*,[360] which stands in contrast to firm-level competition. Vanhaverbeke and Cloodt state that value constellations "[…] are established to create and extract value, they consist of a set of transactions, they combine resources and capabilities of different partners, and are by definition a specific class of inter-organizational networks."[361] Thus, value networks explain the relationships and roles among actors and within the network. In contrast to linear models, value networks creates joint value by redefining these roles and interrelationships instead of adding value chronologically. The offering's configuration is no longer limited by the last firm in a value chain, but is adaptable through changes in network activities if user demands shift. The users' role also changes since they are players within the value constellation network and are therefore co-creators of value.[362] The value network lays the foundation for user integration. It serves as a user interaction network since it maps

[360] Refer to Gomes-Casseres 2003, 329–330.
[361] Vanhaverbeke and Cloodt 2006, 274.
[362] Refer to Norman and Ramirez 1993, 66; Vanhaverbeke and Cloodt 2006, 266; Wirtz 2013, 94.

out transactions between all network partners, whether tangible resources (e.g. user's financial assets) or intangible resources (e.g. user knowledge, usage data, customer loyalty) are transferred and utilized within the network.[363]

Accordingly, value constellation is built on four constituent dimensions: value creation, resources, transactions, and interorganizational networking.[364] Rather than just adding value, the constellation's players create joint value by setting and re-setting roles and relationships within the network. Thereby, resources and competencies are not only considered at firm level but also combined, rearranged, and managed on a network level to create joint value.[365] These resources and competencies embrace tangible (financial, capital-based) and intangible (relationships, knowledge and competencies, process effectiveness and efficiency, level of trust within the organization, and reputation) assets.[366]

Vanhaverbeke and Cloodt claimed that within "[…] constellations value is created through sequences of transactions between the participation companies."[367] Allee defines transactions as the conveyor of value between network players. The currencies of value are both tangible (goods, services, and revenue) and intangible (knowledge, information, loyalty).[368] However, Vanhaverbeke and Cloodt discussed whether minimizing transaction cost or maximizing transaction value is the most suitable strategy. Since value constellation as a specific form of value network implies maximum joint value to compete against other value constellation offerings, transaction value maximization – if transferred from a dyadic to a networked logic – could be a matching approach.[369]

Value constellations are inter-organizational networks, commonly installed around a central or focal firm that takes the role of the network orchestrator. The network's structure mirrors the value creation process. More specifically, resources, roles, relationships, and transactions determine the overall network configuration. The central firm initially chooses the network partners with regard to their resource layout, and negotiates suitable cooperation (e.g. contracting, joint ventures, acquisitions). Based on tangi-

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363 Refer to Allee 2000, 37–38, 2009, 432.
364 Refer to Vanhaverbeke and Cloodt 2006, 274.
365 Refer to Norman and Ramirez 1993, 69–70; Gomes-Casseres 2003, 330–332; Vanhaverbeke and Cloodt 2006, 266–267.
366 Refer to Allee 2008, 6.
367 Vanhaverbeke and Cloodt 2006, 275.
368 Refer to Allee 2000, 37, 2008, 9–10.
369 Refer to Vanhaverbeke and Cloodt 2006, 275.

ble and intangible resources and the firm's ability to translate them into negotiable value, different network roles (e.g. suppliers, complementors, competitors, distributors, users) are set up. The values are transferred between network partners through trans-transactions.[370] Within value distribution, the focal firm must ensure that every network partner benefits from its membership in the value constellation because the constellation's resilience and success is affected "[…] by (a) the extra value created in comparison with competing value systems and (b) the commitment of the different partners in the value constellation."[371]

Gomes-Casseres suggested the following critical factors for successful value constellation: a unifying vision, limited internal rivalry, strong core leadership, limited group sizes, or a layout of norms and rules for similar members.[372]

[370] Refer to Gomes-Casseres 2003, 328; Vanhaverbeke and Cloodt 2006, 259–274; Allee 2008, 9–14; Wirtz 2013, 97.

[371] Vanhaverbeke and Cloodt 2006, 267.

[372] Refer to Gomes-Casseres 2003, 331.

4 Synopsis of theoretical findings

In this chapter, the scope of the dissertation is defined based on the published literature. The research gaps and methodological limitations of previous research are also discussed. To conclude, the leading research question and subordinate research questions will be posed.

4.1 Triadic theory approach

As discussed in the introductory chapter,[373] this dissertation is based on disparate theories. The main research focus is business model theory, particularly business model design and change processes associated with business model dynamics. Solution marketing and network theory also contribute to the theoretical framework of this thesis by applying a user-centric perspective. This triadic theory approach is illustrated in Figure 23.

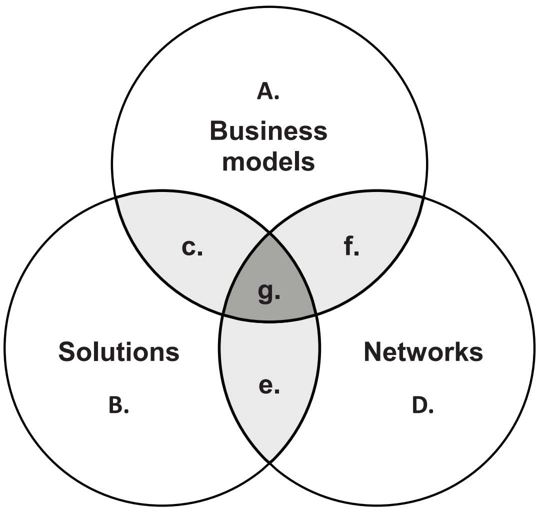

Figure 23: Theoretical foundation – business model theory, solution marketing, network theory.

Section A in Figure 23 includes the findings of chapter 3, which showed that business models can be dynamic with regard to their design and changing value creation with a user-centric perspective.

[373] See chapter 1.

This *dynamic, user-centric business model* approach is the theoretical foundation of this thesis. In chapter 3.1, it was revealed that business model configurations are mostly static and are not dynamic in terms of changing value.[374] The business model configuration presented in this dissertation incorporates a dynamic component that targets value development: *the value development component*. Bieger and Reinhold added value development to their business model configuration in 2011, laying the foundation for a dynamic business model approach.[375] They stated that a business model must be continuously refined or completely innovated, but their value development component did not offer operative guidance for business model dynamics.[376]

Business model dynamics addresses the problem of a static business model perspective and expresses the need for ongoing adaptation due to the changing environment.[377] Literature on business model dynamics has called for continuous monitoring of changes in the business model environment that may influence business model configurations and the consideration of how business model design and change processes affect one another. Business model dynamics remain scientifically underrepresented in the literature.[378]

Chapter 3.2.2 provided important insights into external threats and opportunities of business models, as well as internal factors such as management decisions that can impact the business model. The *fit approach* addresses the constant disequilibrium between internal and external fit that every company has to consider to stay competitive over time.[379] The business model is strongly affected by this imbalance and managers must acquire *dynamic capabilities* to establish *dynamic consistency* between the business model's core elements.[380] Here, chapter 3.2.3 revealed that continuous business

[374] Refer to Morris et al. 2005, 732–733; Cavalcante et al. 2011, 1328; Putten et al. 2012, 140; Saebi 2015, 145–146; Wirtz et al. 2016, 39–41.

[375] Refer to Bieger and Reinhold 2011.

[376] Refer to Bieger and Reinhold 2011.

[377] Refer to Linder and Cantrell 2000, 10; Schweizer 2005, 48; Demil and Lecocq 2010, 241; Putten et al. 2012, 140; Achtenhagen et al. 2013, 431–432; Saebi et al. 2017, 568–569.

[378] See chapter 3.2.1 for business model dynamics.

[379] Refer to Pfau 2001, 5.

[380] Refer to Demil and Lecocq 2010, 239, first mentioned by Teece et al. 1997; Eisenhardt and Martin 2000.

model design and change is categorized as a dynamic capability, which in turn helps managers develop and sustain a competitive business advantage over time.[381]

Section B in Figure 23 represents solution marketing theory, which states that solutions evolve from user-centric approaches, with user needs in the center.[382] As management and marketing literature have developed, the solution approach has solved user problems with offerings that integrate products and/or services. Solution providers and their users are in an *ongoing relational process* that keeps track of changing user needs.[383] The user is also an external factor in the relational process and becomes both a co-creator and a beneficiary of the value offered in the market.[384] With the rise of AmI and IoT, communication and data exchange between provider and user has become greater and faster.[385] The *behavioral customer model* allows the provider to act as an external factor that intervenes in the use process by offering or altering digital services at the point of use.[386]

In **section c** of Figure 23, business model theory and solution marketing are combined into a *solution business model*.[387] The business model's value proposition is structured according to *solution specifications*.[388] This includes an integrated and customized market offering that combines products and/or services. Literature on solution marketing claims that satisfying needs and solving user problems are the main solution outcomes.[389] Solutions should also guarantee a relational process between user and provider.[390] Chapter 3.3.1.3 described how *user-centric market segmentation* can combine solution marketing and business model theory into one user-centric approach. It also revealed that practical implementation of solution-driven, dynamic processes in business models has not been fully investigated. Evanschitzky et al. picked up on this dy-

[381] Refer to Teece et al. 1997; Demil and Lecocq 2010, 244; Amit and Zott 2015, 11–15; Juntunen 2017, 192–194; Teece 2018, 40.

[382] Refer to Levitt 2004; Lamberti 2013, 597 and chapter 3.3.1.1 for the evolution of the solution concept.

[383] Refer to Tuli et al. 2007, 5–8; Ahlert and Kawohl 2008, 12–14

[384] Refer to Vargo et al. 2008, 148.

[385] Refer to Kalka and Abel 2018, 4–6.

[386] Refer to Weiber and Hörstrup 2009, 283–285; Weiber et al. 2011, 114–116.

[387] Refer to Storbacka 2011; Storbacka et al. 2013.

[388] See chapter 3.3.1.2 for solution specifications.

[389] Refer to Nordin and Kowalkowski 2010, 451–452.

[390] Refer to Tuli et al. 2007, 5–8; Ahlert and Kawohl 2008, 12–14.

namic view and stated that this relational process must be transferred into an ongoing solution lifecycle that creates solutions based on user needs over time.[391]

Section D in Figure 23 refers to network theory.[392] As opposed to value chain-based approaches that describe linear processes of adding value, *value networks* are value-creating models that (co-)create and exchange joint value through complex constellations.[393] Because of changing user demands, network roles and interrelationships are redefined constantly. Since value networks consider the user as one of the players within the network, their roles and relationships as a *co-creator of value* also change over time.[394] External-facing value network concepts are therefore user-centric approaches.[395]

Scientists and practitioners have combined solution marketing and network theory (**section e** in Figure 23) with increasing frequency.[396] Hakanen and Jaakkola observed a common application of multi-actor approaches in solution research:[397] that solution providers must cooperate within intra- or inter-organizational networks to integrate their resources and *create joint solutions*.[398] Hakanen and Jaakola found that the value perceived by solution users and suppliers is highly influenced by actors, activities, and resources within the network.[399]

The integration of business models and network theory (**section f** in Figure 23) adds a network perspective to value creation that goes beyond firm or industry boundaries.[400] According to Wirtz et al., moderate research progress has been made regarding *networked business models* and interactions in the value-creating network.[401] A value-delivering network is a value creation and distribution component of the business mod-

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[391] Refer to Evanschitzky et al. 2011, 659.

[392] See chapter 3.3.2 for networks.

[393] Refer to Norman and Ramirez 1993, 69; Vanhaverbeke and Cloodt 2006, 266; Allee 2009, 429.

[394] Refer to Norman and Ramirez 1993, 66; Vanhaverbeke and Cloodt 2006, 266; Wirtz 2013, 94.

[395] Refer to Norman and Ramirez 1993, 77; Stabell and Fjeldstad 1998, 427–429; Allee 2008, 6–7.

[396] For instance Miller et al. 2002, 12; Hakanen and Jaakkola 2012; Biggemann et al. 2013; Ferreira et al. 2013; Frankenberger et al. 2013b; Jaakkola and Hakanen 2013; Storbacka et al. 2013; Windahl 2015.

[397] Refer to Hakanen and Jaakkola 2012, 594

[398] Refer to Miller et al. 2002, 12.

[399] Refer to Jaakkola and Hakanen 2013, 54–56.

[400] For instance Amit and Zott 2001; Zott and Amit 2009; Nenonen and Storbacka 2010; Frankenberger et al. 2013b; Palo and Tähtinen 2013.

[401] Refer to Wirtz et al. 2016, 49, the number of scientific papers on 'actors and interactions' comprise only 5% of the examined business model literature.

el.[402] Wirtz revealed that the network model – as a partial model of the overall business model configuration – ranks above all other partial models as the most relevant component.[403] The integration of business model dynamics into a multi-actor, complex network is challenging. The ability of networked business models to dynamically adapt to changes in user needs has not been well examined in recent literature.[404]

Section g in Figure 23 illustrates the integration of all three theoretical approaches. In the following literature review, this overlap will be used to identify the main gap in the research.

4.2 State of the art, research gap, and research questions

The following (non-exhaustive) literature overview includes papers that focus on at least two of three research fields: business models, solutions, and networks. The purpose of this chapter is to examine the existing knowledge and to determine the research gap in dynamic, user-centric approaches to business model design and change. Table 5 presents the research focus of each paper, including business model design and change processes (business model dynamics), and solution and network theory (user-centric perspective).

The scale describes how intensively a research field has been investigated. The measured identity is the concerned topic (i.e. business models, business model dynamics, solutions, networks). The qualities being measured are the positions (title and/or within the text) and number of listings of the topic in the paper. Topics that represent the main theoretical approach of a paper are considered to have a strong research focus (+++). Topics that influence the overall research but are not the main focus are considered to have a moderate research focus (++). Topics that are mentioned but contribute little to the study’s concept or findings are considered to have a weak research focus (+).

Three papers displayed in Table 5 do not focus on business model theory but discuss the transformation of product firms to solution providers – a solution-centered research focus.[405] Hakanen and Jaakkola took a user-centric view and emphasized the importance of value co-creation in the interplay between users and other network ac-

[402] See chapter 3.1.2, particularly Figure 8 for business model configurations.
[403] Refer to Wirtz et al. 2016, 49–51.
[404] Compare Ferreira et al. 2013; Palo and Tähtinen 2013; Forkmann et al. 2017
[405] Refer to Hakanen and Jaakkola 2012; Biggemann et al. 2013; Jaakkola and Hakanen 2013.

tors.[406] Business models are the major theoretical framework of this dissertation, therefore research into business model design and change were of particular interest.

Many papers on business model design approaches that have been reviewed in this thesis mainly address static business model configurations (Table 5). Only one of the examined papers with a solution and network focus (user-centric) combined business model design and change. Forkmann et al. introduced a service infusion and defusion process model that shows the dynamics of business model reconfiguration.[407] Although they considered business model dynamics, the framework they proposed does not depict the external or internal triggers of change.[408]

Business model dynamics, a scientifically underrepresented topic,[409] is an important component of the literature review presented in Table 5. Dynamic business model approaches initiate the change of a business model in response to changing external factors within a continuum from evolution to innovation. This includes how business model design achieves a configurational fit and hence dynamic consistency. These activities of change and design may take place simultaneously.[410] Palo and Täthinen and Forkmann et al. have considered perpetual business model reconfigurations using iterative loops,[411] but only Palo and Täthinen have considered the notion of simultaneous business model design and change. Nevertheless, their proposed framework does not take solutions or the user as an external factor into account.[412] Other authors have not considered the simultaneousness of business model design and change. Instead, their suggested process steps are consecutive. There is a research gap in the field of business model dynamics, particularly regarding the continuousness, interdependency, and simultaneousness of dynamic approaches.[413]

Theories of business model dynamics more often include a *cycle*[414] to describe dynamic approaches with continuously recurring processes. For this reason, *business model cy-*

[406] Compare Hakanen and Jaakkola 2012; Jaakkola and Hakanen 2013.
[407] Refer to Forkmann et al. 2017.
[408] See chapter 3.2.1.1 for characteristics of business model dynamics.
[409] See chapter 3.2.1.2 for state of the art in business model dynamics.
[410] See chapters 3.2.4.2 and 3.2.4.3 for business model change and design activities.
[411] Refer to Palo and Tähtinen 2013; Forkmann et al. 2017.
[412] Refer to Palo and Tähtinen 2013, 780.
[413] Refer to dynamic approaches in chapters 2.1 and 3.2.
[414] For instance Morris et al. 2005, 733.

cle (BMC) will be used from now on in this dissertation to describe a dynamic, user-centric approach to business model design and change.

Taken together, this literature analysis has revealed that dynamic, user-centric approaches to business model design and change represent a **major gap in the research**.

Research focus	Publication		Research fields			Method
	Author(s), Year	**Purpose/Findings**	**BM*/ BM* Dynamics**	**Solutions**	**Networks**	**Conceptual/ case studies**
BM (d, c)** Solutions Networks*	Forkmann et al. 2017	Conceptualization of a service infusion and defusion process as a business model reconfiguration framework	++ / ++	+	+	case studies
BM (d)** Networks*	Nenonen and Storbacka 2010	Conceptualization of the business model construct depicting value co-creation in a network	+++		++	case studies
BM (d,c)** Networks*	Palo and Tähtinen 2013	Development of a networked business model for emerging technology-based services	+++ / ++		++	case studies
BM (d)** Networks*	Storbacka et al. 2012	Identification of 12 business model design elements that support a focal market actor in developing business models for improved value co-creation	++		++	conceptual
BM (d)** Solutions Networks*	Kindström 2010	Conceptual framework and key aspects for moving towards a service-based business model	+++ / +	++	+	case studies
Networks Solutions BM (d)***	Frankenberger et al. 2013b	Three ideal configurations of networks for open business models	+	++	+++	case studies
Solutions Networks	Biggemann et al. 2013	Customer solution cycle that reflects the process of developing and implementing customer solutions and its effects on the wider business environment		+++	++	case studies
Solutions Networks	Hakanen and Jaakkola 2012	Identification of critical factors affecting the co-creation of customer-focused solutions within business networks		+++	+++	case studies
Solutions Networks	Jaakkola and Hakanen 2013	Description of how value co-creation occurs in the interplay of actors, resources, and activities in solution networks		+++	+++	case studies

Research focus	Publication		Research fields			Method
	Author(s), Year	**Purpose/Findings**	**BM*/ BM* Dynamics**	**Solutions**	**Networks**	**Conceptual/ case studies**
Solutions BM (d)***	Lay et al. 2009	Framework to classify new service-based business concepts	+	++		case studies
Solutions BM (d)** Networks*	Ferreira et al. 2013	Theory concerning business model fit and dynamics in the area of solution business	++ / +	+++	++	case studies
Solutions BM (d)***	Storbacka 2011	Development of a solution business model framework for business model design and management	+	+++		case studies
Solutions Networks BM (d)***	Storbacka et al. 2013	Identification of four continua that are particularly relevant to industrial firms beginning to implement solution business models	+ / +	+++	++	case studies
Solutions Networks BM (c)***	Windahl 2015	Innovation framework for development and commercialization of solutions	+	+++	++	case studies

***BM = Business Model; **(d) = design, (c) = change**

Scale: research focus (+ weak, ++ moderate, +++ strong)

Table 5: Research focusing on business model, solution, and network theories.

Almost 80% of these papers were published in management-related journals, which reflects the main research focus on business model theory. Out of these, more than 70% were published in *Industrial Marketing Management*, revealing a strong business-to-business orientation. Research on solution marketing is usually geared towards the capital goods or manufacturing industry.[415] A business-to-consumer orientation as well as service provider perspectives are mostly neglected.[416] End consumer centricity and service provider inclusion are additional research gaps.

The reviewed papers displayed in Table 5 mostly used case study research. Conceptual approaches were highly underrepresented, and multivariate analysis was never applied (Table 5). This reveals a gap in the methodology: quantitative research including multivariate analysis should be used more in further research.

[415] Refer to Evanschitzky et al. 2011, 657; Hakanen and Jaakkola 2012, 594.

[416] Refer to Davies 2004, 727–729.

This literature review has revealed that the current knowledge base has not integrated user-centric and dynamic models into business model design and change activities. To meet the requirements for a dynamic, user-centric approach, the BMC must incorporate relevant findings from all three research fields: business model, solution, and network theory. The research gap identified in this theoretical analysis and literature review forms the leading research question:

How is a dynamic, user-centric process model for business model design and change configured?

The following subordinate research questions divide the leading question into related subject areas that build on one another:

(1) What are the requirements of a dynamic, user-centric approach?
(2) What are the static, dynamic, and user-centric perspectives in business model theory?
(3) What are the universal mechanisms, phases, components, and input/output streams of a dynamic, user-centric process meta-model for business model design and change?
(4) What are the specific components, process steps, and input/output streams of a dynamic, user-centric process sub-model for the design and change of digitalized business models?
(5) What are the specific activities and input/output streams of a dynamic, user-centric business process for the design and change of digitalized business models

5 The business model cycle (BMC): Deriving a dynamic, user-centric process model for business model design and change

Chapter 4 revealed a lack of theoretical frameworks that combine business model design and change processes with a dynamic, user-centric perspective. In the following chapters, a theory-based business model cycle (BMC) will be constructed to close this gap. For this purpose, the foundation-forming requirements and process model components and their arrangement will be determined. These findings will be examined and transferred into essential requirements for each BMC: the **meta-model**, the **sub-model**, and the **modeled instance**.

5.1 BMC configuration

The comprehensive literature analysis from previous chapters lays the foundation for the BMC's configuration and its underlying content design. However, the process model must also be assessed from a technical perspective to determine its shape, structure, and mechanisms of information flow that enable a dynamic, user-centric configuration. For this purpose, the suitability of meta-process models and their distinct characteristics for the BMC will be examined. Furthermore, the mechanisms of system dynamics will be applied to a business model context and then to the BMC to structure a dynamic, user-centric process model. The model's architecture will be analyzed mathematically and categorized hierarchically into a meta-model, a sub-model, and a modeled instance.

5.1.1 Meta-process models

A process model is an abstract depiction of a process.[417] The BMC is a process model with distinct phases and underlying activities. It systematically defines the sequence of actions needed to change and design a business model.[418] Process models are commonly employed in several disciplines, such as software, product engineering, and service design. As widely discussed in the literature, a process model maps out the activities and procedures needed to pursue a defined objective. The model divides a

[417] Refer to Mohammed et al. 2010, 95.
[418] Refer to Ruparelia 2010, 8; Richter and Tschandl 2017, 163.

process into specific phases using a systemic approach and a higher level of abstraction than a project plan.[419]

Within the software engineering discipline, the *software development life cycle* (SDLC) methodology "[…] for designing, building, and maintaining information and industrial systems […]"[420] gave rise to a variety of process model types, including the waterfall, spiral, or V-shaped model.[421]

Within their service design framework, Bullinger and Meiren structured this vast number of process model approaches and finally distinguished between three different meta-models: **linear**, **iterative**, and **prototype** process models (Figure 24).[422]

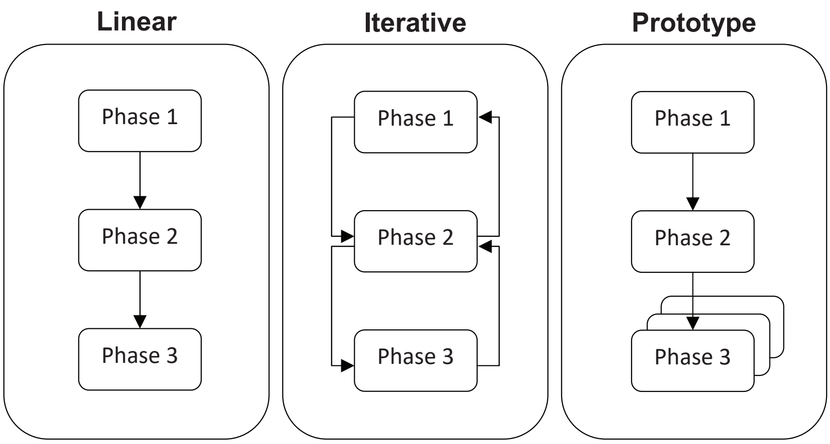

Figure 24: Meta-process models.
Adapted from Bullinger and Meiren 2001, 160–161.

Linear process models (e.g. the waterfall model) are the least complex. They offer a pre-defined sequence of consecutive phases as well as a start- and end point. The completion of one phase is often accompanied by a milestone that attains the phase's objectives. As a result, linear models do not involve iterative processes where objectives or phases are revised based on changing environments.[423]

Iterative process models (e.g. the spiral model) return to previous phases to allow troubleshooting by adjusting the activities in question. Hence, iterative models are more

[419] For this paragraph, refer to Leimeister 2012, 112–113.
[420] Adel and Abdullah 2015, 106.
[421] For a comprehensive overview see Mohammed et al. 2010; Ragunath et al. 2010; Ruparelia 2010.
[422] Refer to Bullinger and Meiren 2001, 159–163.
[423] Refer to Bullinger and Scheer 2006, 117–118; Leimeister 2012, 113.

flexible than linear approaches. Still, the phases are sequential; a phase does not start until the previous phase has been completed.[424]

Prototype process models produce prototypes in early phases of the process that implement the main objective (e.g. design of a service) to consistently review functionality and eliminate errors in early stages. In contrast to the iterative model type, the prototype model allows several process phases to run simultaneously.[425]

The process model type must meet the following requirements for a dynamic BMC:[426]

(1) continuousness (circular feedback)
(2) interdependency and simultaneousness of phases (circular and interlocking feedback).

To examine which process model meets the requirements for a dynamic BMC, the different configurations are tested type-wise in Figure 25.

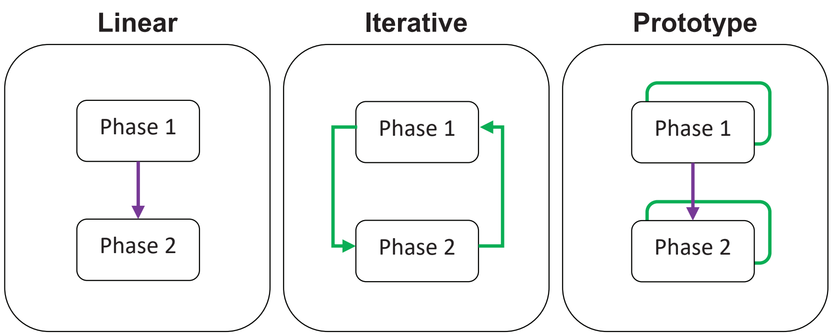

Figure 25: Examination of meta-process model configuration characteristics.
Adapted from Bullinger and Meiren 2001, 160–161.

The linear process model does not comply with requirement (1) or (2) since it has a linear sequence of consecutive phases (purple arrow) that are not iterative, interdependent, or simultaneous. In contrast, the iterative process model fulfills requirement (1) because its iterative structure enables circular loops between phases (green arrows), but does not fulfil requirement (2) because phase 1 can only be repeated when phase 2 is completed – phases cannot run simultaneously. The prototype process model enables phases to run simultaneously (green boxes). However, its linear phase sequence does not allow continuousness or bidirectional interdependencies between phases

[424] Refer to Bullinger and Scheer 2006, 118.
[425] Refer to Bullinger and Scheer 2006, 118–119.
[426] For the derivation of features that enable a dynamic process model see chapter 2.1.

(purple arrow). Therefore, none of these process models meet all requirements for a dynamic BMC.

In the following chapter, system dynamics theory is applied to the BMC to combine meta-process model characteristics into a new configuration that allows continuous, interdependent, and simultaneous process phases.

5.1.2 System dynamics theory for BMC configuration

5.1.2.1 System dynamics logic

The systems approach is used in most fields involving complexities or systems.[427] Formal organizations, such as business enterprises, can also be analyzed as systems that consist of interdependent variables.[428] In the following, systems theory is used to develop the BMC.

The systems approach encompasses different threads; two well-noted concepts are the transdisciplinary *general system theory*[429] by von Bertalanffy and *cybernetics*[430] by Wiener.[431] **System dynamics** is associated with the publication of Forrester's *Industrial Dynamics*,[432] after which it evolved within the dynamic and evolutionary strand of systems theory.[433] The logic of system dynamics applies to any dynamic problem and "[…] systems characterized by interdependence, mutual interaction, information feedback, and circular causality."[434]

Change is the core of system dynamics, and understanding change within systems is its prime objective.[435] It supports continuous learning in complex systems. Sterman describes it as a *management flight simulator* that guides its users through the complexities of dynamic systems.[436] The pilot should understand the reasons for change and policy resistance when a system reacts to interventions in an unexpected way. The

[427] Refer to Bertalanffy 1973, 5.
[428] Refer to Bertalanffy 1973, 9; Maani and Cavana 2007, 142.
[429] Refer to von Bertalanffy 1945.
[430] Refer to Wiener 1948.
[431] Refer to Schwaninger 2009, 8975.
[432] Refer to Forrester 1961.
[433] Refer to Richardson 1991, 296; Schwaninger 2009, 8974–8977.
[434] Richardson 2009, 8967.
[435] Refer to Azar and Vaidyanathan 2018, 574.
[436] Refer to Sterman 2000, 4.

simulator should help recognize system behavior and interdependencies between variables to design a powerful learning process.[437]

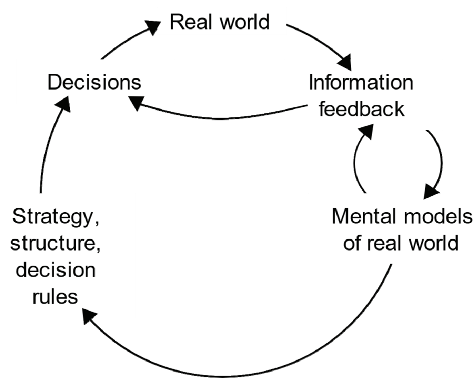

Figure 26: Double loop learning.
Source: Sterman 2000, 19.

The system dynamic's logic is based on *feedback thinking*. Figure 26 illustrates a feedback loop that conveys quantitative and qualitative information from the real world to decision makers whose actions impact the real world in turn. In this manner, decision makers use information feedback to compare the state of the real world with their goals. By making decisions and taking actions, they try to close the gap between the actual and the desired state of the real world, which is a continuous goal-seeking process.[438] This information-feedback system is characterized by *delays*, such as the availability of information and the decisions made and actions taken based on this information.[439] Adding mental real-world models (i.e. perceived, cognitively constructed worlds)[440] to the system enables more dynamic learning since it leads not only to new decisions but also to new understanding of the system's structures, goals, and decision rules.[441] This structure is based on the mechanisms of *circular and interlocking feedback loops*.[442] Whereas circular loops enable continuous feedback processes, the interlocking charac-

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[437] Refer to Sterman 2000, 4.

[438] Refer to Richardson 1991, 304–305; Sterman 2000, 14–15.

[439] Refer to Forrester 1961, 15.

[440] Sterman describes mental models "[…] as collections of routines or standard operation procedures, scripts for selecting possible actions, cognitive maps of a domain, typologies for categorizing experience, logical structures for the interpretation of language, or attributions about individuals we encounter in daily life […]", Sterman 2000, 16.

[441] Refer to Sterman 2000, 16–19.

[442] Refer to chapter 2.1.

teristic of these multiple loops allows interplay between loops that can run simultaneously.[443] Thus, the basic structure of the system dynamics model is based on *feedback loops within a closed boundary*. The system is causally closed, which means that essential inner dynamics (and their self-feeding loops) are separated from negligible outer dynamics. Dynamic behavior patterns are consequences of the internal feedback structure.[444] In comparison, von Bertalanffy's general system theory has a materially closed-system perspective, which Richardson describes as "[…] a corked bottle at constant external conditions […]"[445].

These findings reveal that system dynamics logic meets the general requirements of a dynamic approach where processes and their underlying phases are characterized by continuousness, interdependency, and simultaneousness.[446]

5.1.2.2 System dynamics in the business model context

The logic of system dynamics can be transferred to the **business model context** (Figure 27).

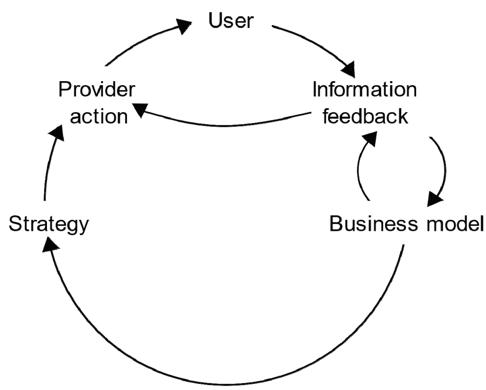

Figure 27: Double loop learning in the business model context.
Adapted from Sterman 2000, 19.

The real world is represented by the user and their needs, preferences, and behavior. The provider's objective is to fulfil user needs with the offered solution. The user can

[443] Refer to Forrester 1961, 14–17; Sterman 2000, 10; Richardson 2009, 8968–8969; Morecroft 2015, 32–38.
[444] Refer to Richardson 1991, 296–299, 2009, 8970–8971; Schwaninger 2009, 8979.
[445] Richardson 1991, 297.
[446] See chapter 2.1 for characteristics of dynamic approaches.

give direct feedback to the provider (e.g. user support) and the provider can monitor the user's behavior (e.g. market research). This information feedback may allow the provider to fulfill unmet user needs.

For example, users may report poor service quality on their rail journey. The provider decides to train their on-board personnel in customer service to improve passenger satisfaction. The implemented measures are partially successful; surveys confirm improved user satisfaction but reveal dissatisfaction with passenger information (e.g. in the case of delays). Once again, the provider takes action and invests in new IT infrastructure and software that provides dynamic, real-time passenger information. Here, the business model represents the provider's mental model of the real world, which includes assumptions about user needs and value creation to fulfil them. In this instance, the provider must adapt their business model. Real-time user information must be added to the value proposition and the value network must be expanded by new IT and software providers.[447] Interdependent business model elements must be redesigned to achieve dynamic consistency between the model's core components.[448] The changes in the business model are incorporated into information feedback, thereby affecting the provider's actions directly. But this large-scale digitalization initiative affects not only the business model but also the operative side of the business and – probably with some delay – the overall business strategy.[449] For example, the rail transport company creates digital user touch points for dynamic passenger information and is now able to communicate and interact with its users bidirectionally. This digital transformation can lead to new digitally minted decision rules where fast-flowing information feedback is answered by provider (re)actions more dynamically and with greater user focus.

These findings reveal that system dynamics logic not only meets the general requirements of a dynamic approach[450] but can also be applied to a user-centric approach thanks to the causally closed information-feedback system of user and provider communication and interaction.[451]

[447] See chapter 3.1.2 for a dynamic and user-centric business model configuration.

[448] See chapter 3.2.3 for the concept of dynamic consistency.

[449] The interdependencies of strategy and business models are not covered within the scope of this dissertation; comprehensive analyses can be found in Magretta 2002; Zollenkop 2006; Zott and Amit 2008; Casadesus-Masanell and Ricart 2010.

[450] See chapters 2.1 and 5.1.2.1 for systems dynamic logic.

[451] See chapter 2.1 for general characteristics of dynamic approaches.

5.1.2.3 Application of system dynamics logic to BMC configuration

Overall, the findings in the previous chapters suggest that the configuration and structure of a dynamic, user-centric BMC is specified through an information-feedback system[452]

(1) with causally closed boundaries as well as[453]
(2) circular and[454]
(3) interlocking feedback loops[455]
(4) that can be characterized by delays.[456]

Figure 28 illustrates the application of system dynamics specifications to the BMC conception. Activities (A) represent actual tasks or abstract steps within a procedure.[457] Related activities are grouped into components (C).

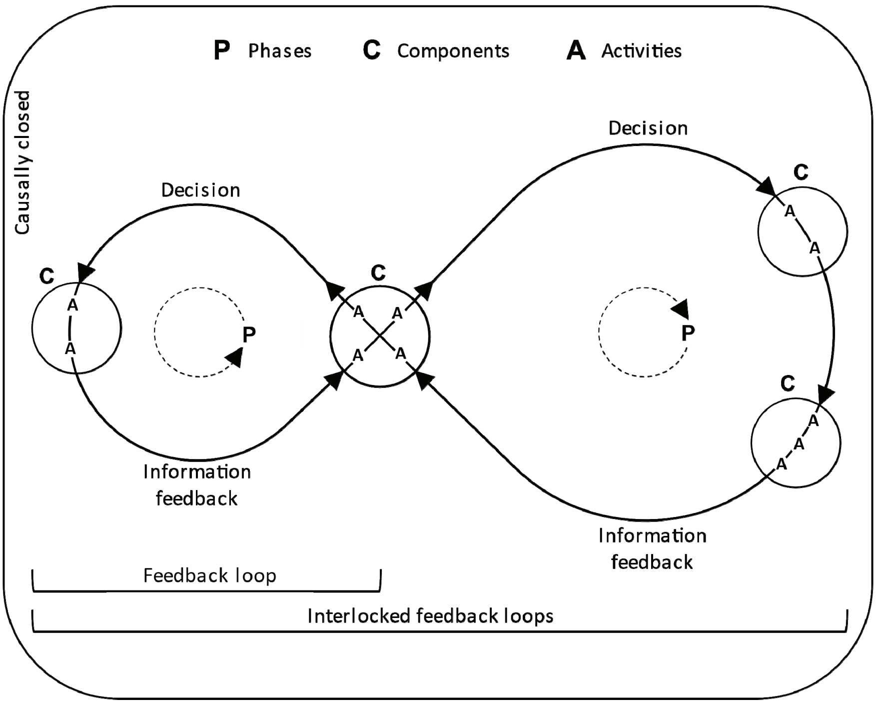

Figure 28: System dynamics logic applied to BMC configuration.

[452] Refer to Forrester 1961, 14–17.
[453] Refer to Richardson 1991, 297–298.
[454] Refer to Sterman 2000, 10–12; Richardson 2009, 8968–8969; Morecroft 2015, 37–38.
[455] Refer to Richardson 2009, 8968–8969; Morecroft 2015, 38.
[456] Refer to Forrester 1961, 15.
[457] See chapter 5.1.1 meta-process models.

Phases (P) contain two or more components and are displayed through a circular feedback loop with information feedback and decisions as input and output streams. Feedback loops that are interlocked share a component and its underlying activities. The information-feedback system is causally closed, which means that the included activities cause patterns of continuous dynamic behavior. The circular loop's sizes indicate the completion time of each phase in comparison with one another. The bigger the circle, the higher the possibility for delays.[458]

5.1.3 Scalability

To analyze the BMC architecture mathematically, it is considered a network. Networks can be represented through graphs that depict nodes and the links between them.[459] Here, the nodes represent a full circular loop, i.e. a process phase. The links are touch points between circular loops, i.e. the number of components that are shared by two phases and interlock these circular loops. To display the number of circular loops (i.e. process model phases) mathematically in proportion to the number of touch points between these loops (i.e. shared components between interlocked loops), **graph theory** was applied to the BMC meta-model. The BMC, $BMC \equiv (P, IC)$, consists of two sets, $P \neq \emptyset \; and \; IC$. The elements of $P \equiv \{p_1, p_2, \dots, p_P\}$ are distinct and are the *phases* of the BMC. The elements of $IC \equiv \{ic_1, ic_2, \dots, ic_K\}$ are distinct unordered pairs of distinct elements of *P* and are *interlocked components*.[460] The number of regular phases describes the order, and the number of interlocked components describe the size of the BMC, which equals *K*. The number of interlocked components is highest

$$\boldsymbol{K_{max}} = \frac{\boldsymbol{P(P-1)}}{\boldsymbol{2}} \qquad \textbf{(1)}$$

when all phases are pairwise linked through interlocked components. The *BMC's* density (*D*) describes the ratio between the actual number of interlocked components (*K*) and the maximum possible number K_{max}:

$$\boldsymbol{D} = \frac{\boldsymbol{K}}{\boldsymbol{K_{max}}} \qquad \textbf{(2)}$$

[458] See chapter 5.1.2.1 for systems dynamic logic.
[459] Refer to Page 2014, 1–3.
[460] Refer to Page 2014, 3.

The maximum density is 1.[461] The denser the *BMC* is, the more interlocked components are installed, which in turn points to a higher number of interlocked feedback loops.

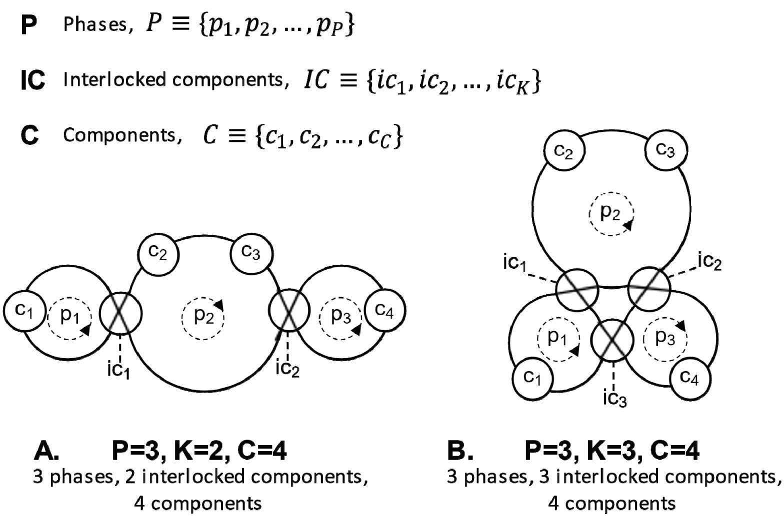

Figure 29: Scalability of the BMC.

Figure 29 shows the **scalable density** of the BMC. For example, if there are three phases, the size of the BMC is at most $K_{max} = \frac{3(3-1)}{2} = 3$, which equates to three interlocked components between phases. A BMC with three phases, for example, could include at least two interlocked phases. In this case, the two phases p_1 and p_3 are not linked through a component, so do not have an interdependent connection. This is a less complex configuration (Figure 29, A). On the other hand, the model could be equipped with (at most) three interlocked components, so that all three phases are interdependent (Figure 29, B).

5.1.4 Hierarchy and classification

The BMC hierarchy maps out the model's versatility, starting with a model that is applicable to all industries and businesses through to a business process for a specific business model. This categorization increases comprehensibility and reduces complexity.

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[461] Refer to Page 2014, 4.

The **BMC hierarchy** distinguishes between three model types: meta-model, sub-model, and modeled instance (Figure 30).[462]

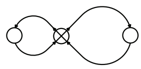
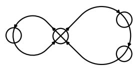
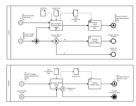
• Incorporates system dynamics logic • Defines number of phases • Presents universal components • Includes universal input and output streams		Chapter 5.2	Conceptual level	**Meta-model**
Additionally or in contrast to meta-model: • Presents specific components • Includes activities in form of abstract steps in the procedure • Shows specific input and output streams between components		Chapter 5.3		**Sub-model**
Additionally or in contrast to sub-model: • Does not present specific components • Includes specific activities • Shows input and output streams between activities • Sets start and end of process		Chapter 5.4	Instance level	**Modeled instance**

Figure 30: The BMC hierarchy.

The *BMC meta-model* is an overarching process model that can be applied to all real-world business models. It uses system dynamics logic to outline universal mechanisms of dynamic, user-centric business model design and change.[463] The BMC meta-model defines the number of actual phases, universally applicable components (including interlocked components), and input and output streams between components.[464]

The *BMC sub-model* is a more detailed and specific form of the BMC. In contrast to the meta-model, it specifies the component structure (including interlocked components) and pre-defines core business model components that are applicable to digitalized business models. Digitalized business models are business models that allow digital and interdependent communication and interaction between user and provider. Solutions marketed within these business models can still include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop), and digital services (e.g. providing car software download for autonomous driving).[465] Additionally, the sub-model adds activities in form of abstract steps in a procedure. Input

[462] The BMC hierarchy is derived from Osterwalder's *business model concept hierarchy* which provides a hierarchical category for business model configurations (business model configurations, see chapter 3.1.2). Refer to Osterwalder et al. 2005, 8–11.

[463] See chapter 5.1.2 for system dynamics theory for BMC configuration.

[464] See chapter 5.2 for the BMC meta-model.

[465] Refer to Loebbecke and Picot 2015, 151–152; Priem et al. 2018, 25–26.

and output streams between components are specified with regard to a digitalized business model.[466]

The *modeled instance* of the BMC serves as an operative business process, i.e. a process diagram, with reference to a digitalized business model. To create the modeled instance, business modeling techniques are used; the business process does not depict specific components, but includes detailed activities. The modeled instance shows input and output streams between activities and adds start and end events to the process.[467]

The **classification of business model concepts** by Bieger and Reinhold classifies the models in the BMC hierarchy. The authors provide four criteria to differentiate between business model-centered concepts:[468] scope, determination of business model component, perspective on time, and depiction (Table 6).[469]

Criteria	Specification	Explanation	BMC hierarchy
Scope	*Universal*	A business and its operations are described in its entirety	Meta-model
	Partial	The model applies to specific industries or describes a pre-selected set of business model components	Sub-model, modeled instance
Determination of business model components	*Ex ante*	Business model components are pre-defined	Sub-model, modeled instance
	Ex post	Universal business model components can be specified over the trial and error of several instances	Meta-model
Perspective on time	*Static*	A business model is analyzed or designed at a specific point in time	-
	Dynamic	Business model change is managed	Meta-model, sub-model, modeled instance

[466] See chapter 5.3 for the BMC sub-model.
[467] See chapter 5.4 for the modeled instance of the BMC.
[468] Here, concepts refer to (process) models, methodologies, tools, configurations, frameworks etc. where a business model is the object of analysis.
[469] Refer to Bieger and Reinhold 2011, 20.

Criteria	Specification	Explanation	BMC hierarchy
Depiction	*Text*	Textual description	Meta-model, sub-model, modeled instance
Depiction	*Graphic*	Graphical presentation	Meta-model, sub-model, modeled instance

Table 6: Classification criteria for business model concepts.
Adapted from Bieger and Reinhold 2011, 20; Mezger 2018, 54.

The *scope* defines whether or not the model applies to all business and industry contexts.[470] The BMC meta-model has a dynamic, user-centric business model design and change concept that can be applied to every business context. The BMC sub-model and the modeled instance focus on digitalized business models,[471] and business model components, activities and/or input and output streams between components or activities are pre-defined.

Business model components, such as the value proposition,[472] are either pre-defined and integrated within the model at hand or are developed by the model itself.[473] The BMC meta-model specifies suitable business model components ex-post over the trial and error of several instances. In comparison, the BMC sub-model and the modeled instance provide a pre-defined set of business model components whose underlying elements are designed in line with user information feedback.

The *perspective on time* determines whether the business model is at a specific point in time (static) or is evolving over time (dynamic).[474] The BMC is a dynamic process model, which means that it's phases should be continuous, interdependent, and simultaneous. Furthermore, the BMC depicts business model change and design over time.

The *depiction* of the concept is either graphical and/or in text form.[475] All three hierarchies of the BMC will be described through illustrations and text.

[470] Refer to zu Knyphausen-Aufseß and Meinhardt 2002, 21; Zollenkop 2006, 29.
[471] See Footnote 465.
[472] See chapter 3.1.2 for business model components.
[473] Refer to Demil and Lecocq 2010, 231.
[474] Refer to Demil and Lecocq 2010, 228.
[475] Refer to Bieger and Reinhold 2011, 20.

5.2 BMC meta-model

The BMC meta-model is an overarching process model that can be applied to all real-world business models that are dynamic and user-centric. It uses system dynamics logic to outline universal mechanisms of dynamic, user-centric business model design and change.[476] The following chapters define the number and substance of phases, universally applicable components, and input and output streams between components.

5.2.1 Configuration requirements

The BMC meta-model configuration is based on *system dynamics logic*. This is found in information-feedback systems with causally closed boundaries as well as circular and interlocking feedback loops that can include delays [477]

<table>
<tr><th colspan="2">Criteria for dynamic, user-centric approach</th><th>BMC meta-model configuration based on system dynamics logic[478]</th></tr>
<tr><td rowspan="2">Dynamic[479]</td><td>Continuousness</td><td>Application of circular feedback loops.</td></tr>
<tr><td>Interdependency;
simultaneousness</td><td>Application of circular and interlocking feedback loops as well as an indicator for probability of delays.</td></tr>
<tr><td rowspan="2">User-centric[480]</td><td>Enabling factors:
Organizational integration;
data integration</td><td rowspan="2">Implementation of user and provider phase, and installation of touch point between phases. The process model is causally closed (user as only external factor).</td></tr>
<tr><td>Constituting factors:
Bidirectional communication and interaction process;
proactive customization;
user integration</td></tr>
</table>

Table 7: Configuration requirements of dynamic, user-centric BMC meta-model.

As discussed in chapter 5.1.2, the system dynamics logic can be applied to the BMC configuration to ensure a dynamic, user-centric approach for business model design and change. In the right column of Table 7, the criteria for dynamic, user-centric approaches as well as the corresponding mechanisms of system dynamics logic are ap-

[476] See chapter 5.1.2 for system dynamics theory for BMC configuration.

[477] See chapter 5.1.2.3 and Figure 28 and refer to Forrester 1961, 14–17; Richardson 1991, 297–298, 2009, 8968–8969; Sterman 2000, 10–12; Morecroft 2015, 37–38.

[478] See chapter 5.1.2 for systems dynamics characteristics.

[479] See chapter 2.1 for constituting factors of dynamic approaches.

[480] See chapter 2.3 for enabling and constituting factors of user centricity.

plied to the meta-model.[481] This overview provides a guideline for the configuration of the BMC meta-model.

5.2.2 BMC meta-model phases

To enable continuously running phases, the meta-model incorporates circular loops. One circular loop equals one process phase,[482] so the number of phases must be determined. In a user-centric approach, the user is the focus of attention and the only factor to be considered in the provider's business model environment.[483] According to system dynamics logic, the user is only an external factor in a causally closed system; the interplay of user and provider creates a dynamic and self-feeding pattern within the boundaries of the BMC meta-model. As a result, the BMC meta-model consists of two phases:

- A **user phase** (p_U) for communication and interaction between user and provider as well as business model prototyping (design) and user observation (change)
- A **provider phase** (p_p) for business model ideation, prototyping and integration (design) as well as analysis and conceptualization (change).

Figure 31 illustrates the BMC meta-model configuration. To allow not only continuously (circular loops) but also interdependently and simultaneously (interlocked loops) running phases, the two phases are interlocked at the touch point.

The size of the circle indicates the time required to complete each phase. Answering a user's information feedback (decision), such as a general user request, takes less time than changing the business model.

[481] See chapters 2.1 and 2.3 for a general definition of dynamic and user-centric approaches. Figure 28 shows the graphical application of system dynamics logic to the BMC.

[482] See chapter 5.1.2.3 for application of system dynamics logic to BMC configuration.

[483] See chapter 2.3 for the characteristics of user centricity. Also see chapter 3.2.2 for a detailed description of the external and internal factors that impact the business model.

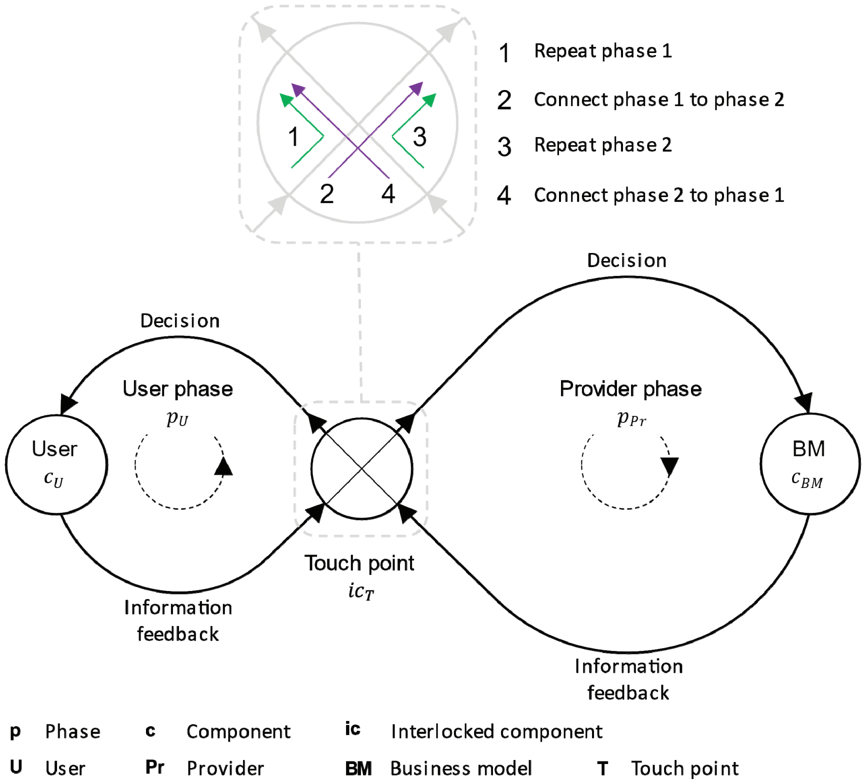


Figure 31: BMC meta-model.

The **user phase** includes *communication and interaction* between user and provider, which can take place in the user's or the provider's environment.[484] For example, the user buys a train ticket online (information feedback). Here, the touch point between user and provider is an online booking platform and the user is in their environment. The provider sends the digital train ticket to the user (decision). In another example, the user visits a dealer to buy a car. Here, the user phase takes place in the provider's environment. However, when they drive the new car or ride the train, the user is in their own environment, but constantly creates information feedback through their user behavior. As a result, the user phase involves the *use process* as a source of information.[485] If the provider is able to install a digital (e.g. smartphone app) or physical (e.g. service counter) touch point, this information on the use process can be collected. User demands,

[484] Refer to Tuli et al. 2007, 2; Evanschitzky et al. 2011, 657 for the relational communication and interaction process in solution marketing. See also chapter 2.3 for the characteristics of user centricity.

[485] Refer to Weiber and Hörstrup 2009, 283–287.

such as a complaint at the service desk, can be answered directly and the user gets a decision (e.g. user receives a credit note).

Regardless of whether information feedback leads to a direct provider decision or not, the procedure of monitoring and collecting information feedback is called *observation* and is the initial step of business model change.[486] Since the user phase goes beyond the simple act of purchasing a solution, *prototyping* can be part of the user phase. In a field test, a business model prototype is presented to the user who gives the provider their feedback.[487]

The **provider phase** is connected to the user phase through the interlocked touch point. User information feedback that was collected during the user phase is sent to the provider for *analysis* and *conceptualization*, two essential steps in the business model change process.[488] Analysis includes ordering, identifying patterns in, and making sense of information feedback. Using the actual business model as a reference,[489] the analysis determines the business model change needed within an evolution to innovation continuum.[490] Subsequent conceptualization defines the changes to business model components and their interdependencies; these are necessary to understand the impact of business model change.[491]

The provider phase includes *ideation, prototyping*, and *integration*, which are essential business model design activities.[492] The provider creates an initial concept in line with user needs, i.e. the results of the business model change conceptualization, and roughly depicts the business model's components.[493] The *ideation* of a business model does not always translate to a new design; sometimes small adaptations are made to single components.[494] Ideation identifies potential gaps, creates ideas, and guarantees their feasibility by creativity techniques.[495] *Prototyping* requires detailed business model components and overall ontologies. These elaborate business models are further re-

[486] See chapter 3.2.4.2 for business model change activities.
[487] Refer to Osterwalder and Pigneur 2010, 165.
[488] See chapter 3.2.4.2 for business model change activities.
[489] Refer to Gassmann et al. 2017b, 28–30.
[490] Refer to Amit and Zott 2015, 7–8.
[491] Refer to Demil and Lecocq 2010, 241; Juntunen 2017, 82–83; Wirtz 2018, 322.
[492] See chapter 3.2.4.3 for business model design activities.
[493] Refer to Frankenberger et al. 2013a, 265–267.
[494] Refer to Amit and Zott 2015, 8.
[495] Refer to Schallmo 2013a, 157–164; Mezger 2018, 110–117; Wirtz 2018, 267–270 for creativity techniques.

fined and evaluated during prototyping field test within the user phase.[496] *Integration* refines business model components, compares the remaining business model options, and selects a business model alternative.[497] Integration focuses on the internal fit, i.e. consistency between business model components.[498] Designers specify business model components and their underlying elements in detail and take interdependencies into account to create an aligned and functioning business model.[499]

5.2.3 BMC meta-model components

As outlined above, the BMC meta-model considers the user as the only external factor that affects the provider business model. Therefore, the meta-model comprises **two universal components** that can be applied to every business model and industry: the user component c_U and the business model component c_{BM}.

The *user component* represents the user in their environment, showcasing their use process, distinct user profiles, and behaviors.[500] Here, the user is also a part of business model design (prototyping) and change (observation) activities.[501] The *business model component* is the provider's mental model of the real world. Here, the provider designs (ideation, prototyping, integration) the business model to fulfil real-world user needs.[502]

The user and provider must be able to interact and exchange information feedback and decisions bidirectionally.[503] Hence, both phases are interlocked, which can be shown mathematically. The meta-model comprises two phases: p_U and p_{Pr}. The maximum number of interlocked components (K) is:

[496] Refer to Osterwalder and Pigneur 2010, 254–255; Amit and Zott 2015, 9–10; Wirtz 2018, 274–275. Schallmo provides an exhaustive review of business model prototyping from design to extension and evaluation of prototypes. Refer to Schallmo 2013a, 190–204. Gassmann et al. are the only authors to assign the prototyping phase to implementation activities. Refer to Gassmann et al. 2017b, 66–69.

[497] Refer to Osterwalder and Pigneur 2010, 254–255; Wirtz 2018, 240–279.

[498] Refer to Frankenberger et al. 2013a, 265–267.

[499] Refer to Schallmo 2013a, 148

[500] Profile data include sociodemographic data, habits, opinions, desires/needs, preferences, experiences, hobbies as well as context information (e.g. used devices/goods/infrastructure), see chapter 3.3.1.4 for the mechanisms of the behavioral customer model.

[501] See chapter 5.2.2 for a detailed description of BMC meta-model phases and underlying process steps. See also chapters 3.2.4.2 and 3.2.4.3 for business model change and design activities.

[502] See chapter 5.1.2.2 for system dynamics in the context of business models. Also see chapter 3.2.4.3 for business model design activities.

[503] See chapter 2.3 for general requirements of a user-centric approach.

$$K_{max} = \frac{P(P-1)}{2} = \frac{2(2-1)}{2} = 1$$ [504]

Accordingly, the meta-model contains:

- two universal components c_U and c_{BM}
- one universal and interlocked component ic_T which is represented by the touch point between user and provider.

The meta-model's density is its highest value, which is:

$$\frac{K}{K_{max}} = \frac{1}{1} = 1$$ [505]

since the actual number of interlocked components (*K*) equals its maximum possible number K_{max}. Hence, the user and provider phases are fully interdependent and produce continuous patterns of dynamic behavior (self-feeding, interlocked loops).[506]

The touch point involves business model change activities. It gathers information feedback (observation) and processes this information (analysis, conceptualization) to make decisions about business model change.[507]

The magnified illustration in Figure 31 describes the mechanisms within the touch point in detail. Information or results that emerge from the user component enter the touch point and can be processed, distributed back to the user component (1), and/or forwarded to the provider phase (2). When distributed back to the user component, the touch point acts as a phase-repeating element; in the second case, the touch point functions as a phase-connecting element. Both paths can be taken simultaneously (1+2). Proceeding from the provider phase, the touch point acts as a phase repeater and passes information (probably processed information) back to the provider component (3) or forward to the user phase (4). Here, too, the touch point becomes a repeating and/or connecting element for both phases and allows simultaneous transmission of information (3+4). However, the touch point not only sets the direction for information flow (phase-repeating vs. phase-connecting) but also includes information-processing activities as depicted in the BMC sub-model.[508]

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[504] Refer to equation (1) in chapter 5.1.3.

[505] Refer to equation (2) in chapter 5.1.3.

[506] Refer to the mechanisms of system dynamics in chapter 5.1.2.

[507] See chapter 5.2.2 for a detailed description of BMC meta-model phases and underlying process steps. See also chapter 3.2.4.2 for business model change activities.

[508] See chapter 5.3 for the BMC sub-model.

The exchange of feedback and decisions through the touch point has not been defined in a technical way. The BMC meta-model sets the general logic and directions of information flow but does not specify the technical application (e.g. information exchange at point of sale, through customer services, via digital channels, etc.). Accordingly, the meta-model can be applied to every business model regardless of information-applied exchange procedures.

Since the BMC meta-model outlines universal mechanisms of dynamic, user-centric business model design and change, it neither assigns specific activities within its universal components nor predefines a specific business model configuration.[509] Consequently, it can be applied to every business model and industry.

5.2.4 BMC meta-model input and output streams

The BMC meta-model has two universal input and output streams between components: *information feedback* and *decisions*. According to dynamic systems logic, decisions are based on information feedback.[510] The user conveys information feedback, such as specific demands or problems, to the provider. The provider might monitor user behavior and gather information feedback actively.[511] This information feedback is conveyed and/or processed within the interlocked component (touch point between user and provider).[512] The output is a decision, such as a direct reaction to user requests or demands. For example, the user misses their connecting train. Here, the touch point is a travel center at the rail station. The provider decides to offer two alternatives: another train one hour later or a long-distance bus leaving earlier. The user chooses the alternative train (information feedback) and gets the corresponding ticket (decision). The service employee puts the user's selection on computer. This concludes the user phase. More user information feedback can be processed, and patterns can be recognized. Finally, the provider decides to change the business model since most users do not choose to take the long-distance bus. Accordingly, the provider adapts the offering and revokes the contract with the bus company. The information on the redesigned business model is sent as feedback to the touch point. Service personnel will no longer offer bus tickets to users who missed a connecting train.

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[509] See chapter 5.1.4 and Table 6 for classifications of the BMC.
[510] Refer to Richardson 1991, 304–305; Sterman 2000, 14–15.
[511] These distinct pull and push mechanisms are further described within chapter 5.3.4.1.
[512] This process of data processing is described in detail in chapters 5.3.4.2 and 5.4.3.2.

5.3 BMC sub-model

The BMC sub-model is more detailed and specific than the meta-model. It has a broader component structure and pre-defines core business model components that are applicable to digitalized business models.[513] It also describes the component's activities in form of abstract steps in a procedure. Input and output streams between components are specified with reference to digitalized business models.

5.3.1 Configuration requirements

The BMC sub-model configuration is based on *business model, solution, and network theory* to create a dynamic, user-centric process model for business model design and change.[514] As shown in the previous chapter, system dynamics logic can be applied to the business model context. The meta-model integrates a user and a business model component and an interlocking touch point component in between.[515]

[513] Within this dissertation, *digitalized business models* are understood as business models that incorporate technical facilities for a digital and interdependent communication and interaction between user and provider. Solutions that are marketed within these types of business models can still include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop) as well as digital services (e.g. providing car software download for autonomous driving).

[514] See the synopsis of theoretical findings in chapter 4.

[515] See chapter 5.2.3 for BMC meta-model components.

In contrast to the meta-model, the sub-model incorporates specific components that can be applied to a digitalized business model:[516]

- Point of use (PoU)[517]
- Value development[518]
- Value proposition[519]
- Value creation and distribution.[520]

The PoU is deduced from solution theory, while the other components are also based on the dissertation's business model configuration.[521]

Table 8 presents the general criteria for dynamic, user-centric approaches as well as the configurations of corresponding sub-model components. This overview provides a guideline for the configuration of the BMC sub-model.

[516] Within this dissertation, *digitalized business models* are understood as business models that incorporate technical facilities for a digital and interdependent communication and interaction between user and provider. Solutions that are marketed within these types of business models can include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop) as well as digital services (e.g. providing car software download for autonomous driving).

[517] See chapter 3.3.1.4 for the approach of provider integration where the user creates value at their PoU.

[518] See also chapter 3.1.2 and Figure 8 for a business model configuration including a value development component.

[519] See also chapter 3.1.2 and Figure 8 for a business model configuration including a value proposition component.

[520] See also chapter 3.1.2 and Figure 8 for a business model configuration including a value creation and distribution component.

[521] See chapter 3.3.1.4 for the PoU in solution marketing and chapter 3.1.2 for business model configurations.

Characteristics of a dynamic, user-centric business model approach		**BMC sub-model configuration based on business model,[522] solution,[523] and network[524] theory[525]**			
		Configuration requirements of BMC sub-model components, their underlying activities and connecting input and output streams			
		Point of use (PoU)	**Value development (VD)**	**Value proposition (VP)**	**Value creation and distribution (VCD)**
***Dynamic*[526]**	*Continuousness*	Implementation of behavioral customer model mechanisms to enable continuous flow of user data (information feedback).	Installation of user interface that enables continuous flow of solutions (decisions), user data (information feedback), and solution data (information feed-back). Installation of data analytics to continuously analyze user and solution data and enable continuous flow of value development data (decisions).	Presentation of user segments, user benefits, and solution specifications that can be constantly assessed and redefined in response to or in anticipation of changing external (user) factors.	Presentation of network set up that can be constantly assessed and redefined in response to, or in anticipation of, changing external (user) factors.
	Interdependency	Implementation of behavioral customer model to enable interdependent relationship between provider and user.	Installation of user interface that enables interdependent communication and interaction between user and provider. Installation of data analytics to interdependently analyze user and solution data and guarantee dynamic consistency (internal and external fit).	Value proposition must be designed and changed with respect to dynamic consistency between the business model's core components (interdependency of internal + external fit).	Value creation and distribution must be designed and changed with respect to dynamic consistency between the business model's core components (interdependency of internal + external fit).
	Simultaneousness		Installation of user interface that enables simultaneously running business model change and design activities.		

[522] See chapters 3.1 and 3.2 for static and dynamic perspectives on business model theory.

[523] See chapter 3.3 for a user-centric perspective on business models and 3.3.1 for solution theory in particular.

[524] See chapter 3.3 for a user-centric perspective on business models and 3.3.2 for network theory in particular.

[525] See chapter 4.1 for overview of applied theory approaches that form the dissertation's overlapping boundaries of research.

[526] See chapter 2.1 for constituting factors of dynamic approaches.

User-centric[527]	***Enabling factors***				
	Organizational integration		Internal: Installation of user interface that aligns entirety of user touch points within the company.		External: Integration of user assets in value network.
	Data integration	Implementation of behavioral customer model, which is an IT-enhanced approach of push and pull activities between user and provider.	Installation of user interface that collects user data (information feedback). Installation of data analytics activities to analyze user and solution data.		
	Constituting factors				
	Bidirectional communication and interaction process	Implementation of behavioral customer model to enable bidirectional communication and interaction process between provider and user.	Installation of user interface that enables bidirectional communication and interaction process between provider and user.		
	Proactive customization	Implementation of behavioral customer model to observe changes in user data that can induce a proactive customization.	Installation of data analytics to analyze user and solution data and conceptualize business model change.	Installation of user-centric market segmentation for solution creation; Implementation of solution offerings that are customized, integrated, if necessary modularized combinations of products and/or services which are collaboratively created for an individual or a set of users.	
	User integration	Implementation of behavioral customer model to gather user data (assets). IT-enabled user co-creation shows in the user's pull activities within the behavioral customer model.	Installation of user interface that allows the user to co-create value.		Integration of user in value network in terms of their assets and role as co-creators.

Table 8: Configuration requirements of dynamic, user-centric BMC sub-model.

527 See chapter 2.3 for enabling and constituting factors of user centricity.

5.3.2 BMC sub-model phases

The BMC sub-model configuration, like the universal configuration of the BMC meta-model, has one user phase p_U and one provider phase p_p (Figure 32).

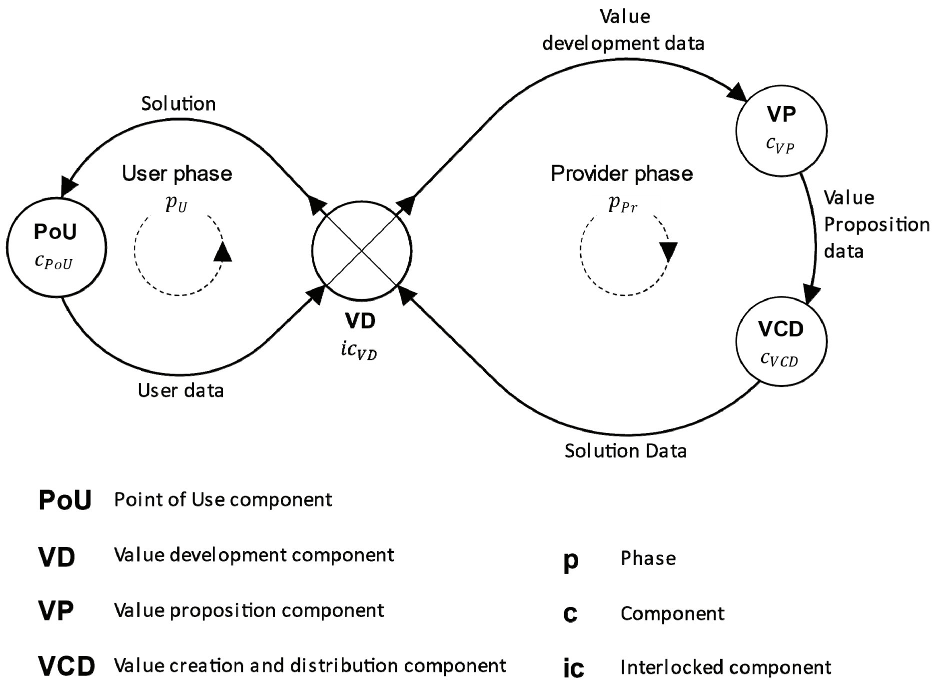

Figure 32: BMC sub-model.

Both the user phase and provider phase involve **business model design and change activities**. Since phases in the sub-model and meta-model are the same, a detailed description of both phases can be found in chapter 5.2.2. As mentioned in chapter 5.1.2.3, phases (P) contain two or more components whose input and output streams are information feedback or decisions. The sub-model specifies these components, their underlying activities, and the input/output streams between them.

5.3.3 BMC sub-model components

The BMC sub-model includes one user-sided and three provider-sided components. The user-sided component is designed on the basis of chapter 3.3.1. The provider-sided components are configured based on the theoretical analysis described in chapter 3.

5.3.3.1 Point of use (PoU) component

Solution theory has revealed an important relational process between provider and user for user-centric and dynamic business model approaches. Lasting communication between provider and user guarantees an exchange (e.g. of knowledge, skills) that has greater value than one-time transactions of products or services.[528] This relational process introduces a dynamic perspective because information is continuously exchanged. As a result, the offered solution is more likely to meet current user demands.[529] User needs not only provide the basis for initial configuration of the solution but also (according to business model theory) trigger continuous business model change.[530] Therefore it is necessary to install a monitoring process within the realm of business model change activities that can detect or anticipate changes in user needs.[531] The behavioral customer model provides mechanisms for information exchange and collection and should be an integral part of the PoU.[532] These requirements reflect the need for a BMC submodel component that conveys user-based processes in their entirety. At the PoU, the solution is used, and this goes beyond the simple act of purchasing a product and/or service. The user experiences the offering's true value as they use it. Consumption-related usage data, user needs, or specific user demands emerge within the user's environment.[533] In addition to the exchange of values between user and provider, the user should be monitored at the PoU to gather real-time usage data.[534] Monitoring is associated with business model change, while prototyping is an essential phase of business model design. A field test at the PoU introduces a business model prototype to the market and examines user acceptance and feasibility.[535]

5.3.3.2 Value development component

Value development is a business model component that observes, analyzes, and conceptualizes business model change.[536] It defines an integrated value transition process

[528] Refer to Vargo and Lusch 2004, 15.
[529] Refer to Tuli et al. 2007, 5–8; Ahlert and Kawohl 2008, 12–14.
[530] Refer to Schallmo and Brecht 2010, 13.
[531] See chapter 3.2.4.2 for business model change activities.
[532] See chapter 3.3.1.4 for mechanisms of the behavioral customer model.
[533] Refer to Weiber and Hörstrup 2009, 283–287.
[534] See chapter 3.3.1.4 for the behavioral customer model.
[535] Refer to Osterwalder and Pigneur 2010, 164–165 and see chapter 3.2.4.3 for business model design activities.
[536] Refer to Bieger and Reinhold 2011 and see chapter 3.2.4.2 for business model change activities.

from monitoring the user as an external factor within the business model environment to initiating business model change.[537] The relational process between provider and user ensures a continuous flow of user data that is central not only to value creation but also to dynamic value change.[538] With technologies such as AMI, IoT, or artificial intelligence, the speed and volume of data exchange increases and becomes more dynamic.[539] Here, a user interface provides the centralized touch point between user and provider.[540] The user interface and underlying data pool also guarantee an exchange of information between sub-model components. Therefore, value development acts as an interlocked component that allows activities and phases to run simultaneously (e.g. business model change activities such as observation and design activities such as ideation). Value development should also observe the user, analyze user data, and conceptualize business model change through data analytics.[541]

5.3.3.3 Value proposition component

According to business model theory, value proposition determines the benefits proposed to the user, user segments, and the solution's specifications.[542] Following the user-centric view of solution theory, offerings are principally designed to fulfill user needs.[543] These solution offerings integrate products and/or services to create added value and must be customizable to please different users.[544] Furthermore, a user-centric value proposition should be based on a user-centric market segmentation.[545]

A market offering with modular structure is more likely to be dynamically adjustable in response to changing user needs. As opposed to an offering with inseparable components, one that is modularized and customizable can be discarded or exchanged at lower cost.[546]

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537 Refer to Slywotzky 1996; Bieger and Reinhold 2011; Saebi 2015.
538 Refer to Tuli et al. 2007, 2–8; Evanschitzky et al. 2011, 657.
539 Refer to Weiber and Hörstrup 2009, 283–285; Weiber et al. 2011, 114–116.
540 See chapter 2.3 for the necessity of an overarching user interface for all user touch points.
541 See chapter 3.2.4.2 for business model change activities.
542 Refer to zu Knyphausen-Aufseß and Meinhardt 2002; Morris et al. 2005; Bieger and Reinhold 2011.
543 Refer to Nordin and Kowalkowski 2010, 451–452.
544 See chapter 3.3.1.2 for solution specifications.
545 Refer to von Berg and Graff 2016, 46; von Berg and Randelhoff 2019.
546 Refer to Leimeister 2012, 20 and see chapter 3.3.1.2 for solution specifications.

5.3.3.4 Value creation and distribution component

Within the scope of this dissertation, value creation and distribution defines the networked logic of added value. The value network determines resources, roles, relationships, and transactions, where value is the currency.[547] User-centric approaches, where the user is part of value creation, were part of the theories examined in this dissertation.[548] For example, in business model theory, the user is a network partner in a networked business.[549] In network theory, value networks are composed of partners (including users) who define their roles and relationships through their assets that are combined on a network level to create joint value. The user's assets could be both tangible (such as revenue) and intangible (such as information or knowledge).[550] However, in solution theory, the user not only takes part in the value creation network but also actively co-creates value using their assets.[551]

5.3.4 BMC sub-model activities and input and output streams

5.3.4.1 Activities and input/output streams within the PoU component

The PoU contains activities with abstract process steps.[552] Its requirements were derived from a comprehensive literature review. These requirements include communication between user and provider as well as monitoring users as external factors to facilitate business model change.[553] These requirements (Table 8) are transferred into process model activities that take place at the PoU.

The **behavioral customer model**[554] originates from provider integration theory. It is an IT-enhanced approach that creates an environment where the provider is able to monitor the user's behavior (e.g. driving data of a car user) to create smart services (e.g. telematic-based insurance service).[555] With its distinct user-centric orientation, the mod-

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[547] See chapter 3.3.2.2 for value networks.

[548] See chapter 4.1 for overview of applied theory approaches that form the dissertation's overlapping boundaries of research.

[549] Compare for example Amit and Zott 2001; Zott and Amit 2009; Nenonen and Storbacka 2010; Frankenberger et al. 2013b; Palo and Tähtinen 2013.

[550] See chapter 3.3.2 for networks.

[551] Refer to Dyer and Singh 1998, 660–661; Amit and Zott 2001, 503; Vargo and Lusch 2006, 285; Vargo et al. 2008, 148; Chesbrough 2010, 355; Zott et al. 2011, 1029; Palo and Tähtinen 2013, 774.

[552] See chapter 5.1.4, particularly Figure 30 for the BMC hierarchy.

[553] See Table 8 for the configuration requirements of a dynamic, user-centric BMC sub-model.

[554] See chapter 3.3.1.4, particularly Figure 19 for the behavioral customer model.

[555] Refer to Weiber and Hörstrup 2009, 285–286.

el uses solution marketing and incorporates the latest technology.[556] It is also dynamic, as several streams of information are continually exchanged between user and provider and are transported via networks composed of embedded intelligent devices and objects.[557] Direct communication between user and provider during the use process is technically limited to prosumer services (e.g. hairdresser, health care services) where a user is both the consumer and the (co-) producer of a service. The emergence of social media and mobile commerce, where both user and provider are present at the PoU (e.g. social media platform) and co-produce value, has paved the way for new forms of prosumerism.[558]

Provider integration offers a new approach to service provision as a consequence of technology-enabled information exchange. The provider's response time to changes in users' needs can be reduced, or reactions can even become automatic. The Adidas micoach service[559], for instance, measures the athlete's heart rate, GPS position, and running speed and delivers these real-time data to the provider. Adidas can supervise the optimal speed, route, or provisioning during the user's training. This allows the provider to monitor the user and offer support services at the PoU.[560]

Within the framework of **customer integration**, the customer acts as an external production factor within the provider's service provision. In contrast, within the framework of provider integration, the provider designs the use processes. Smart services and digitalized business models allow provider integration to extend the customer integration concept. The behavioral customer model incorporates both provider integration and customer integration. [561]

The behavioral customer model is dynamic and user-centric, so can be implemented in the BMC sub-model. In the following, provider integration theory and the corresponding behavioral customer model will be applied to the PoU.

Figure 33 illustrates **PoU activities** as abstract steps within a process. Two connecting points between the user- and provider-sided components are displayed. Dashed lines

[556] See chapter 3.3.1.4 for the technology-enabled behavioral customer model.
[557] Refer to Footnotes 329 and 330.
[558] Refer to Weiber et al. 2011, 115; Kasper et al. 2012, 176; Schögel and Knaak 2017, 477.
[559] Adidas discontinued the service, but is incrementally migrating it to the acquired Runtastic mobile app.
[560] Refer to Weiber et al. 2011, 114–115.
[561] Refer to Weiber and Hörstrup 2009, 295–298.

represent provider-sided components, and these are examined in the following chapters.

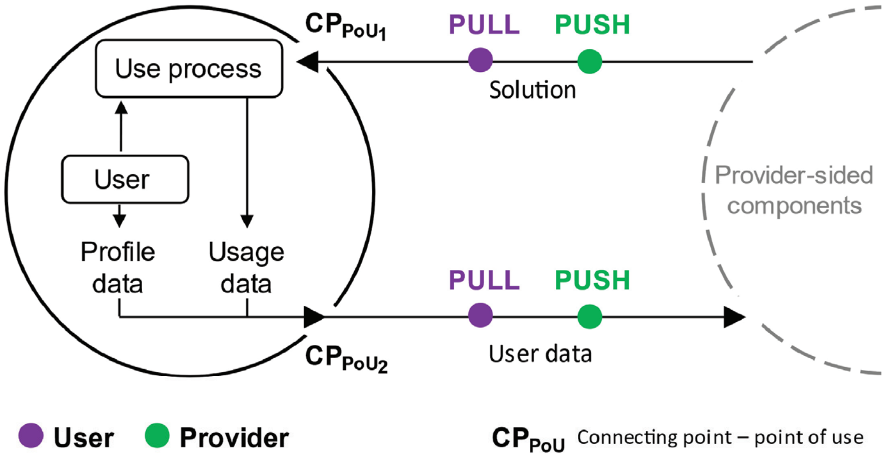

Figure 33: The point of use component.

Both consumption of the solution and activation of the value in use take place at the PoU. The *use process* is the key element at the PoU, where a solution and the user create value in use. For example, a car conveys the provider's knowledge and skills in automotive manufacturing. But when the user drives the car on public roadways, actual value is created. Using new technologies (telematics etc.), the car can now be connected to the outside world, and the provider can monitor the user's behavior during the actual use process.[562] At the connecting point (CP_{PoU1}), the PoU's **input stream of solutions** infiltrates the use process. Whether it is a digital service (e.g. a bus ticket on an app) or a physical product (e.g. delivery of a new cargo bike), the solution's genuine value is created during the use process. Purchase of the offering and the transfer of ownership may happen earlier.[563] The behavioral customer model has a *pull-push mechanism*: i.e. the solution use is either user-induced or provider-induced. A provider-induced solution use describes provider integration, i.e. the provider pushes a specific offering into the user's use process (e.g. an alternative driving route during a traffic jam).

562 Refer to Vargo and Lusch 2008, 256; Vargo et al. 2008, 148; Weiber and Hörstrup 2009, 283–288; Weiber et al. 2011, 114–116.

563 Refer to Weiber et al. 2011, 114–115.

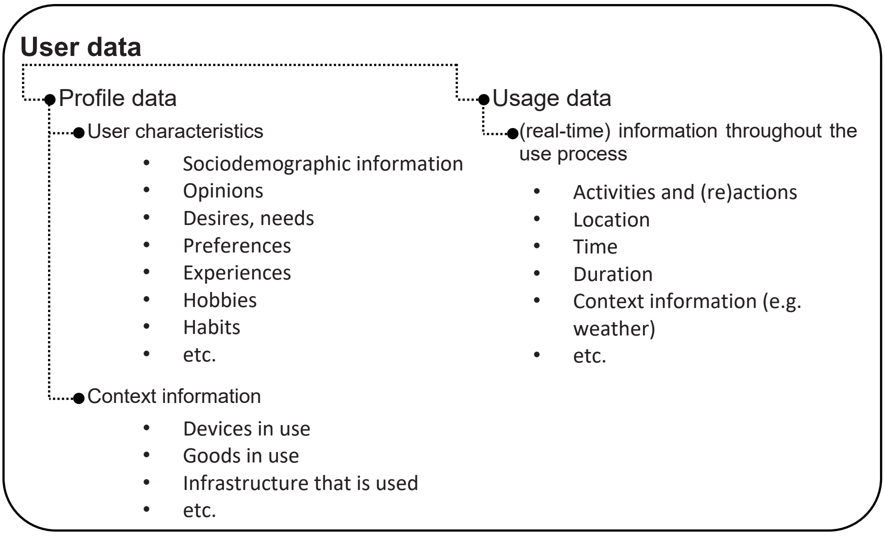

Figure 34: User data.

The AmI and IoT enable the provider to gather profile and usage data to derive user demands. *Profile data* include users' characteristics (e.g. sociodemographic data, habits, opinions, desires/needs, preferences, experiences, hobbies) and context information (e.g. used devices/goods/infrastructure) (Figure 34). *Usage data* include real-time information of the use process (e.g. real-time activities and actions within the use process, location and time of usage, context/environmental information), which can be consolidated into usage histories and frequencies as well as number of activities and reactions from the user over a period of time (Figure 34).[564]

In an *AmI environment*, intelligent mobile networks span the globe, offering information, communication, and entertainment. With technological development, these devices become more ambient-sensitive and can adapt to their user's needs.[565] In addition to AmI environments, IoT technology has made everyday objects smart, such as home appliances, buildings, or infrastructures. Embedded hardware, software, process and network architectures, radio-frequency identification (RFID), near field communication (NFC), and sensors can connect these objects so they can sense, identify, store, process, and send information across the internet.[566]

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[564] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118.
[565] Refer to Vasilakos and Pedrycz 2006, 1.
[566] Refer to Whitmore et al. 2015, 261–265.

These new technologies and intelligent environments have increased the "[…] volume, variety and velocity (3Vs) of data […]"[567]. Analysis of these data is part of **data analytics**, which detects unforeseen patterns of data sets and provides the basis for human decision-making. In many cases, these data sets are related but come from different repositories. This sometimes leads to validity problems, especially when unstructured data sets of uncertain quality are formatted. Proper harvesting and handling of big data is still an issue, despite diverse analytics techniques.[568]

Artificial intelligence (AI) manages big data analytics and increases automation.[569] It includes machine learning, which is the ability of machines to accomplish tasks while implementing autonomous improvements without human interference. Machines are no longer programmed for a particular outcome, they are training with and learning from examples.[570] They "[…] operate autonomously, perceive their environment, persist over a prolonged time period, adapt to change, and create and pursue goals."[571] AI allows computers to act rationally. *Natural language procession* is the ability to interpret and communicate human language in text, audio, or visual format. Through *knowledge representation*, the machine is able to store everything it knows or hears, and through *automated reasoning* it can use this information to answer questions and draw conclusions. As described above, machine learning is conducive to adaptation, pattern detection, and further development by virtue of new environments and circumstances. Some of these abilities rely on *computer vision*, which enables the machine to perceive and discern surroundings and objects. *Robotics* form the AI's physique and make movement and physical interaction possible.[572]

The **push mechanism** is enabled through technology; the provider can not only individualize but also push a service into the use process in real time, i.e. when a new user demand is emerging. These technologies described above can also gather profile and usage data from the user and translate them into user profiles that are then used to customize offerings. [573]

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[567] Tan et al. 2017, 4998.

[568] For instance, predictive analytics, data mining, case-based reasoning, exploratory data analysis, business intelligence, machine learning techniques. Refer to Tan et al. 2017, 4998.

[569] Refer to Grandinetti 2015, 15–16; Tan et al. 2017, 4998.

[570] Refer to Brynjolfsson and Mcafee 2017, 4–7.

[571] Russel and Norvig 2016, 4.

[572] Refer to Russel and Norvig 2016, 2–4; Berinato 2017, 17.

[573] Refer to Weiber et al. 2011, 118–119.

Several companies already incorporate these technologies in their business activities to improve and engage in use processes. *Uber*, for instance, uses AI to take the user from A to B quickly and easily. The user simply gives their desired destination, and AI compares traffic and routing data from other drivers on a similar route to deliver the optimum solution (i.e. the fastest route from A to B).[574] The Google-owned company *Nest* offers the 'Nest Learning Thermostat', a self-programming IoT-enabled and mobile app-controlled thermostat that detects use patterns and adapts to its users' preferences accordingly.[575] *Nest* customers can also sign up for the 'Rush Hour Rewards' program, which authorizes the Nest thermostat to automatically tune temperatures in high-demand periods and rewards the user with payments or incentives (like a free thermostat).[576] AI can detect patterns, which enables providers like *Netflix* to create smart content that is personalized, and customize the services constantly.[577] Chatbots and virtual agents combine natural language processing and machine learning to mimic human communication and are used in e-commerce and customer service to interact with users.[578] For instance *Facebook M* – Facebook's Messenger AI – can intervene in use processes by reacting to comments or personal messages and making customized suggestions. It is still in development and has only been launched in selected countries so far, but Facebook M might offer to order a taxi for you if you text 'I'll be there in 30 minutes' via Facebook, or show you a selection of burger restaurants if you comment 'Staying in New York this week, any recommendations for the best burger in town?'.[579] After *Amazon*'s patent for anticipatory shipping was granted in 2013, the company launched their 'shopping-then-shipping' business model.[580] With its predictive capabilities, Amazon's AI can accurately determine which, where, and when goods should be shipped without the customer making a purchase. The model is dynamic and responsive, e.g. it can decide whether goods are pre-shipped in a general direction or to a precise address.[581]

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[574] Refer to Merrick 2016.
[575] Refer to Nest Labs 2017a.
[576] Refer to Nest Labs 2017b.
[577] Refer to Merrick 2016; Allen 2017; Faggela 2017.
[578] Refer to Merrick 2016; Allen 2017.
[579] Refer to Berinato 2017, 18.
[580] Refer to Lomas 2014.
[581] Refer to Agrawal et al. 2017

This technology-enabled **push-mechanism** is based on (real-time) profile and usage data, and can process service provision automatically and virtually when or even before a customer makes a demand.[582]

In contrast, the **pull-mechanism** describes the rather traditional process of a demand- or problem-driven request from user to provider. In the technology-equipped provider integration approach, direct communication is key instead of a shop-bound transaction. User profile or usage data (i.e. preferences, demands, and problems during the use process) prompts the provider to adapt the solution, thereby integrating the user into service provision. Here, the user induces adaptation of the offering. The relational connection between provider and user means the user can pull the desired offering to their PoU.[583] This pull-mechanism resembles customer self-service.

The implementation of the behavioral customer model into the PoU component is the basis for a user-centric, mixed-criteria segmentation method since the provider can identify accurate user profiles from profile and usage data, and receive real-time user demands and problems during the use process.[584] The PoU's **output stream of user data** leaves at the CP_{PoU2} connecting point before entering the provider-sided component.

The pull-push mechanism of the behavioral customer model enables the provider not only to market user-centric offerings but also to integrate **business model design and change activities** within the user's environment. Testing *prototype* business models is a business model design activity and can either be offered directly to the user through the push mechanism or be deliberately acquired by the user through the pull mechanism.[585] The latter is the case, for example, when a user signs up to be a beta tester on an online platform, in a lab, or in the real world. The provider can collect user data from the use process or by communicating with the user. This business model change activity is called *observation*.[586] On the one hand, the user can deliberately send profile data with a view to receiving more customized solutions. On the other hand, the provider can gather profile data and offer incentives in return, or collect real-time usage data. This depends on whether the user and provider are digitally connected at the PoU at the

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[582] Refer to Weiber et al. 2011, 118.
[583] Refer to Weiber et al. 2011, 118–119.
[584] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118–119.
[585] See chapter 3.2.4.3 for business model design activities.
[586] See chapter 3.2.4.2 for business model change activities.

same time, the connection of the environment (e.g. AmI, IoT), or the software and tools at hand (e.g. big data analytics, AI, robotics).

5.3.4.2 Activities and input/output streams within the value development component

Value development interlocks the user and the provider and is the touch point between user and provider components. It also contains essential activities for business model change. Because of continuous user monitoring, data analysis, and exchange, value development is responsible for the dynamization of the BMC sub-model. The requirements of Table 8 are transferred into actual process model activities that take place during value development.

Business model theory is often static and lacks continuously changing environments and value.[587] **Business model dynamics** address this inflexibility. Continuous monitoring of internal and external factors can initialize necessary changes to the business model and its configuration.[588] Bieger and Reinhold incorporated value development into their business model. They did not provide operative guidance or instructions for business model change. In contrast, value development of the BMC sub-model offers abstract steps within a procedure that can continuously develop value over time.[589]

Value development activities allow the BMC sub-model to be dynamic. However, since value development should link continuous and interdependent communication between user and provider, it must implement a user interface that aligns user touch points within the company. It must collect, process, and provide both the latest solution specifications and user data. Big data analytics can be used to observe users, identify patterns, and determine which kind of business model change is needed and how it will affect business model components.[590] The exchange of activities between user and provider can also be enhanced by new technologies such as AMI, IoT, or AI.[591] External (user data) factors that can influence the business model configuration must be monitored. Value development activities must provide a link to the remaining provider-sided components and incorporate business model change. Business model design and

[587] Refer to Morris et al. 2005, 732–733; Cavalcante et al. 2011, 1328; Putten et al. 2012, 140; Saebi 2015, 145–146; Wirtz et al. 2016, 39–41.

[588] See chapter 3.2.4.2 for business model change activities as well as chapter 3.1.2 for business model configurations.

[589] Refer to Bieger and Reinhold 2011.

[590] Refer to Loebbecke and Picot 2015, 151–155; Woerner and Wixom 2015, 60–62; Günther et al. 2017, 197–198.

[591] See chapter 5.3.4.1 for an overview of suitable technological applications and tools.

change may occur simultaneously within different BMC sub-model phases. For example, the user is continuously monitored during the user phase and at the same time, business model ideas are made during the provider phase. This simultaneousness of phases and underlying activities can be managed by value development. It connects phases and allows phases to be repeated.[592]

Figure 35 illustrates the abstract steps in a procedure, including the collection, pooling, deployment, analysis, and transfer of data. At connecting point CP_{VD1} an **input stream of user data**, i.e. profile and usage data, pass into the value development component. The data are collected in a database that is directly linked to the **user interface**. These interfaces allow human-computer interaction and are frequently used in several products and services, such as home appliances, navigation devices, consumer electronics, smartphone applications, and websites. Software applications that are combined with high usability interfaces – such as mobile apps – offer a variety of functions to a wide group of users without special technical understanding.[593] Here, value development uses online software to transmit services and data via the internet, thereby providing a continual link between user and provider. These web applications (e.g. websites, mobile apps for the smartphone or car screens) provide a graphical user interface where the user can navigate and interact through buttons or voice control.[594]

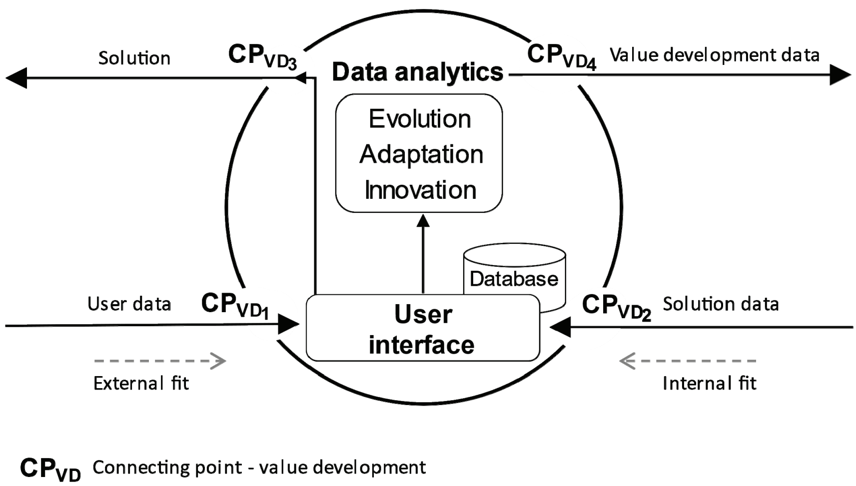

Figure 35: The value development component.

[592] See chapters 5.2.2 and 5.2.3 for the universal functionality of interlocked components, see also Figure 31 in particular.

[593] Refer to Thesmann 2016, 1.

[594] Refer to Thesmann 2016, 4.

User data are stored in a database which is linked to the interface. **Input streams of data**, i.e. solution information and specifications, enter the value development component at connecting point CP_{VD2} and are stored in the interface's adjacent database. This database stores user and solution data, and these data provide the basis for data analytics. *Profile data* contains information on the user and their environment (Figure 34). Profile data range from sociodemographic data to self-articulated or methodically collected preferences, needs and opinions. Context information describe the user's surroundings, i.e. the technical devices, goods, and infrastructures they commonly use. *Usage data* are generated during the use process and are transferred – if technically feasible – in real time (Figure 34). Every user activity and action (active and passive) within the use process (e.g. making use of specific solution modules, reaching out for enquiries/demands/problems) as well as further information on location, time, and context of usage (e.g. used devices, ambient temperature, current heart rate, body temperature) are examples of usage data.[595] Collecting and pooling data represents the **observation step within business model change**.[596]

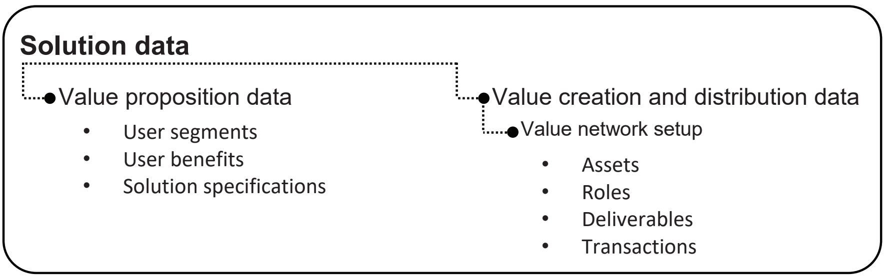

Figure 36: Solution data.

To offer solutions through the user interface, the online software accesses the latest solution data (Figure 36). At this point, the user interface offers two options for solution provision: the *pull*- and the *push-mechanism*.[597] When a user pulls a solution from the use process, or the provider pushes an offering into the use process, the **output stream of solutions** exits the value development component at connecting point CP_{VD3}

[595] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118.

[596] See chapter 3.2.4.2 for business model change activities.

[597] The behavioral customer model works with a pull-push mechanism that allows for provider integration into the use processes of the user, see chapter 3.3.1.4.

to offer the solution to the user at their PoU.[598] The push-mechanism represents activities where the provider both customizes and pushes a service into the use process in real time (provider integration).[599] The pull-mechanism resembles customer self-service, where the user individually configures his or her solution (customer integration).[600] For this purpose, the user pulls a service from the user interface into their use process.

Regardless of whether the solution is pulled or pushed, the user is guaranteed to receive the solution because of continuous interaction between users and providers at the user interface.

Data analytics retrieve user profile and usage data (including information on user problems and specific demands) from the interface's adjacent database. Big data analytics can detect unforeseen patterns and interpret complex data sets needed for decision-making.[601] BMC data analytics compare and combine user data and solution data to determine whether the offered solution meets user needs and preferences. Data analytics begin automatically when new user and/or solution data arrive in the user interface.[602]

Big data analytics can detect data patterns as well as data matches and misfits.[603] This analysis is an important part of business model change.[604] For this purpose, user profile and usage data are summarized into user profiles which are clustered heterogeneously against one another.[605] These user profiles include real-time user demands and problems. Processed user data are then compared with solution data to examine whether the offered solution can fulfill user needs. This requires an algorithm-based evaluation and categorization of matches and misfits.

Mathis and Köbler observed a knowledge gap in data-driven business model innovation: the **data-need fit**.[606] The data-need fit matches user needs with available company data to provide a substantial foundation for value proposition design. Mathis and Köbler distinguished between internal and external as well as rotational and continuous data. In-

[598] See chapter 5.3.4.1 for input/output streams within the PoU component.
[599] Refer to Weiber and Hörstrup 2009, 283–285; Weiber et al. 2011, 114–116.
[600] Refer to Stauss and Bruhn 2009, 5; Lamberti 2013, 596–597.
[601] Refer to Tan et al. 2017, 4998.
[602] The specific sequence of activities is presented in chapter 5.4.3.
[603] Refer to Grandinetti 2015, 15–16; Tan et al. 2017, 4998.
[604] See chapter 3.2.4.2 for business model change activities.
[605] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118.
[606] Refer to Mathis and Köbler 2016, 461–463.

ternal, company-owned data (such as in-house user research, internal resources, or stakeholder maps) and continuous data are valuable for business model innovation.[607] According to Mathis and Köbler, a data-need fit is realized "[…] when one or more available data sources have been identified that have the potential to support relevant customer tasks, alleviate problems, or create benefits for the user."[608] The data-need fit process was initially described as a supporting mechanism for business model innovation, but the authors also highlighted the importance of early user feedback in establishing ongoing business model adaptation.[609] The data-need fit concept agrees with the logic of *business model dynamics* investigated in this dissertation, where a business model is continuously assessed and revised in response to, or in anticipation of, changing external and internal factors.[610] The data-need fit concept detects internal or external data sources that solve user problems or create user benefits and can be transformed into market-ready products and/or services.[611]

In this dissertation, the data-fit concept is used to develop and sustain an internal and external fit and hence a competitive advantage over time.[612] This allows the degree of consistency between user needs and the solution from the business model design to be implemented. The user is the external factor and is operationalized by analyzing user data. The current business model design is operationalized using solution data (Figure 36). The objective of the data-need fit model is *dynamic consistency*.[613] Dynamic consistency refers to a business model in a permanent state of transitory disequilibrium.[614] The business model's adaptation to the external factor (user) is called the external fit. The internal fit refers to how internal factors influence the progression of a business model design from ideation to integration. Figure 35 illustrates how external and internal fit affect business model change. Within the BMC sub-model, reaching dynamic consistency is a continuous data analytics process, and this is introduced in the next paragraph.

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[607] Refer to Mathis and Köbler 2016, 461–463.
[608] Mathis and Köbler 2016, 463–464.
[609] Refer to Mathis and Köbler 2016, 465.
[610] See chapter 3.2.1 for the concept of business model dynamics.
[611] Refer to Mathis and Köbler 2016, 460–465.
[612] See chapters 3.2.3 and 3.2.4.4 for the mechanisms of the fit approach in application to business model design and change.
[613] For the concept of dynamic consistency see chapters 3.2.3 and 3.2.4.4, and Figure 14 in particular.
[614] Refer to Demil and Lecocq 2010, 241–242.

Figure 35 illustrates the outcomes of the data analytics process within business model change.[615] According to Saebi's framework, these outcomes represent the **three types of business model change:** business model evolution, adaptation or innovation.[616] Business model innovation is either the reformation of an existing business model or the innovation of a new business model. Adaptation and evolution are less radical; they affect fewer areas of the business model and the planned outcome ranges from minor or natural adjustments (evolution) to alignments with the business model environment (adaptation). Even though the frequency of change is higher for evolution and adaptation, business model innovation brings novelty to the industry and disrupts market conditions.[617] Dynamic consistency and Saebi's definition of evolutionary change suggest that a business model is constantly evolving and changing.[618]

Table 9 connects business model change proposed by Saebi with the applied data analytics process. It also provides consistent examples for every type of business model change.

	Business model evolution	**Business model adaptation**	**Business model innovation**
Outcome of data analytics process	Solution data match user data to a high degree; low data disparity; high data-need fit (e.g. solution satisfies user needs)	Solution data match user data to a moderate degree; moderate data disparity; moderate data-need fit (e.g. specific solution module is rarely used; share of users with augmented reality (AR)[619]-ready mobile devices increases, but solution is not AR-ready)	Solution data match user data to a low degree; high data disparity; low data-need fit (e.g. no solution data provided/no business model existent yet)
Planned outcome of change	Natural, minor adjustments (e.g. strengthening of ties between solution network partners)	Align with the environment (e.g. elimination of solution module; development of AR-supporting solutions)	Disrupt market conditions (e.g. design of business model that is new to the market)

[615] The mechanisms, tools, and methods of big data analytics and the overall technical implementation of the data analytics process is not within this dissertation's scope. Comprehensive literature reviews and technical overviews can be found in Chong and Shi 2015; Gandomi and Haider 2015; Zheng 2015; Yaqoob et al. 2016; Grover and Kar 2017; Janssen et al. 2017; Santos et al. 2017; Ghasemaghaei et al. 2018; Saggi and Jain 2018.

[616] Refer to Saebi 2015.

[617] Refer to Saebi 2015, 148–151.

[618] Refer to Demil and Lecocq 2010, 239–241; Saebi 2015, 148–149.

[619] Azuma et. al "define an AR system to have the following properties: combines real and virtual objects in a real environment; runs interactively, and in real time; and registers (aligns) real and virtual objects with each other.", Azuma et al. 2001, 34.

	Business model evolution	**Business model adaptation**	**Business model innovation**
Scope of change (number of business model components affected)	Narrow (e.g. value creation and distribution component are affected)	Narrow – wide (e.g. value proposition as well as value creation and distribution component are affected)	Wide (e.g. all components are affected)
Degree of radicalness	Incremental (e.g. revision and extension of network partner contracts)	Incremental – radical (e.g. adaptation of user benefits, solution specification, and entire network setup)	Radical (e.g. new design of market segmentation, user benefits, solution specification, network setup
Frequency of change	Continuous, gradual changes (e.g. expiration of partner contracts)	Periodical (e.g. revelation of new use patterns or context of use after continuous review of usage data)	Infrequent (e.g. business model innovation after major strategy shift or with new business formation)
Degree of novelty	Not applicable	Novelty is not a requirement (e.g. elimination of former solution module; design of novel AR-supporting solution)	Must be novel to the business or industry (e.g. new solution business model)

Table 9: Types of change in context of the BMC.
Adapted from Saebi 2015, 150.

To determine whether a data-need fit has been achieved and which type of business model change should be chosen, user and solution data must be analyzed and compared. Computing and coding mechanisms and technical implementation of data analytics is beyond the scope of this dissertation. However, a range for big data analytics' outcomes must be defined to prepare a data-driven and algorithmic approach for decision-making. There are probably various states of data matches and mismatches which describe a certain level of data disparity. These states are 'solution data match user data to a high degree' (high data-need fit), 'solution data match user data to a moderate degree' (moderate data-need fit), and 'solution data match user data to a low degree' (low data-need fit). A scale must be defined to distinguish these levels of data disparity. An ordinal scale was chosen that assigns the groups as low data disparity, moderate data disparity, and high data disparity (respectively, high data-need fit, moderate data-need fit, low data-need fit). The aim of this dissertation is to design a transferable model instead of an individual case analysis, therefore pre-formulated operationalization of data disparity levels or determination of applied algorithms is not supplied. In Table 9, fitted examples of data analytics outcomes and corresponding repercussions regarding business model change are presented. The definition of repercussions represents the **conceptualization step within the business model change process**.[620]

Business model evolution is an initial data analytics outcome. The evolution of business models "[…] refers to the effective standardization, replication, implementation, and maintenance of the existing business model".[621] These incremental adjustments often arise naturally over time, and aim to make the activities and relations of the business operation more effective and efficient. The BMC sub-model begins to evolve when user and solution data match, i.e. when data disparity is low. This might be the case when user needs are largely satisfied by the solution offering (**high data-need fit**). According to value proposition logic,[622] the benefits proposed by the provider satisfy user needs and the solution matches the user's needs.[623] Based on the respective outcome of data analytics, business model evolution is initialized. Business model evolution involves minor adjustments that are continuous and incremental and affect only parts of the business model.[624]

According to the *conceptualization* of business model change, strategic objectives and recommendations for action should be formulated before they are transferred to the value proposition component.[625] Following data analytics, it can be assumed that the solution matches user needs, and that the business model components (value proposition as well as value creation and distribution) are properly configured and matched to each other. To support and consolidate this functioning business model configuration, strategic partnerships and network ties may be strengthened by revising and extending partner contracts. This minor adjustment might occur periodically (expiration of contracts) and solely affects the value creation and distribution component. These recommendations for business model evolution summarize an example outcome of business model change process.

Starting to **adapt a business model** is a second potential outcome of the analysis step within business model change. Business model adaptation is primarily a "[…] process of

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[620] See chapter 3.2.4.2 for business model change activities.

[621] Saebi 2015, 150.

[622] See chapter 3.1.2 for business model configuration and underlying components, such as the value proposition.

[623] Refer to Reichardt 2008, 80–81.

[624] Refer to Saebi 2015, 148–150.

[625] See chapter 3.2.4.2 for business model change activities.

continuous selection, adaptation, and improvement to fit a changing environment”.[626] As opposed to business model evolution, initializing business model adaptation is only triggered by external factors, i.e. changes in the business model environment. Since the BMC sub-model is designed around a user-centric logic,[627] the evolution of user needs and preferences is a relevant external factor that must be monitored. Following the logic of the data-need fit model, a business model should be adapted when there is a disparity between user and solution data. User profiles and particularly usage data may reveal low usage of a specific solution module. In another case, usage data may reveal that users of public transport often get lost at big mobility hubs and miss their service. The data (especially context information) may also show that more and more users are using AR-ready mobile devices. If the offered solution does not provide AR-enhanced routing services, user needs would only be partly satisfied or user satisfaction could be increased overall, i.e. a **moderate data-need fit** would be given. Within the process of conceptualization, an AR-enhanced routing option could be implemented in the provider’s app to improve user satisfaction.

Business model adaptation involves periodical changes that align the business model with its changing environment. These changes do not have to be novel; they can range from incremental to radical adaptations that affect at least one component of the business model.[628] A variety of situations may lead to business model adaptation. For example, solution data might indicate that two user segments are targeted, while new user profiles indicate that a third cluster must be created with distinct preferences and characteristics. Alternatively, preferences for specific solution services may be detected that indicate more in-depth development of these solution modules. Once analysis has determined the type of business model change, conceptualization can begin to define the necessary adaptations to business model components to better understand the impact of business model change.[629]

For example, in the case mentioned above, AR-ready mobile devices were used more frequently, so the solution offering could be adapted to support AR-enhanced routing services. The business model’s value proposition, value creation, and distribution component will be affected by the changes. Distribution will probably change radically since

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[626] Refer to Saebi 2015, 148–150.
[627] See chapters 2.3 and 3.3.1 for user-centric logic.
[628] Refer to Saebi 2015, 148–150.
[629] Refer to Demil and Lecocq 2010, 241; Juntunen 2017, 82–83; Wirtz 2018, 322.

network partners might be added or excluded from the network. Network setup must be reconfigured. The value proposition must also be altered in terms of user benefits and solution specifications. If a solution is adapted or newly designed, it might be novel to the market. This example of solution extension, which advises business model adaptation, might be a conclusive outcome of the business model change process.

The third possible outcome of business model change analysis is **business model innovation**. In contrast to business model evolution and adaptation, business model innovation not only increases efficiency and alignment with the environment but also shapes market conditions by disruptive innovation.[630] In the BMC sub-model, innovation is necessary when user and solution data only match to a small extent, i.e. when data disparity is high. There are two scenarios when this would be the case: either the current business model and the corresponding solution do not satisfy user needs (**low data-need fit**) or no solution data exist that can be compared with user data. The latter is true when a new business model is designed, and no solution data are available yet. Either way, business model innovation involves radical changes that affect many or all business model components. This type of business model change occurs rarely, but its market-disrupting outcome must be novel to the business or the whole industry.[631] If, for instance, no solution data are available, then the innovation process for a business model is initialized. This might be the case if a start-up company is founded or a major shift in business strategy motivates the innovation of a new business model of an established company. Here, user data (gathered from market research or previous users) are the foundation for business model design. When a new business model is created, every component and its underlying elements are affected, including user segments, user benefits, solution specifications, network setup, and value development infrastructure (e.g. user interface).[632]

[630] Refer to Saebi 2015, 151.
[631] Refer to Stampfl 2016, 39.
[632] See chapter 3.1.2 for business model components.

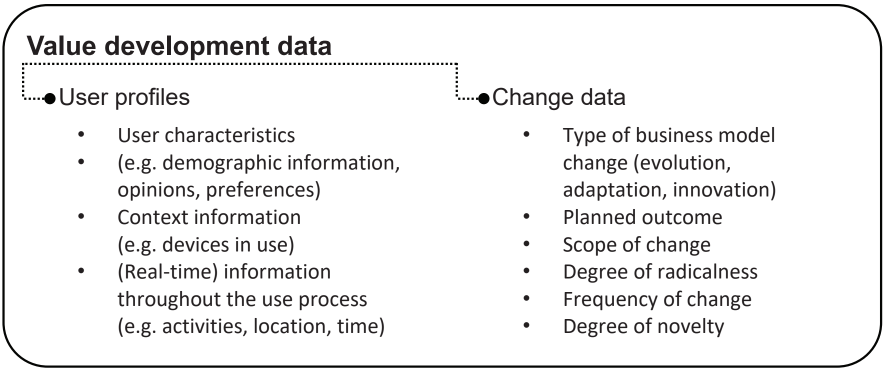

Figure 37: Value development data.

The conclusive output stream of data analytics includes user profiles, suggestions for business model change, and planned alterations to the business model components. These are value development data (Figure 37). Value development data form the basis of business model design. At connecting point CP_{VD4} the **output stream of value development data** is transferred to the value proposition component.

Value development should allow **simultaneously running phases**, so its configuration is analyzed in greater detail. Figure 35 depicts the two-stranded structure of value development. The left-sided strand describes the user-interface-enabled connection between user and provider, which includes user observation and solution provision. The right-sided strand illustrates data analytics, which involves the analysis and conceptualization of business model change. The user interface connects both strands. However, both strands can run independently from each other. Whenever new data arrive at connecting point CP_{VD1} or CP_{VD2}, the provider and/or the user phase come into action (this can happen simultaneously).

Overall, value development makes a BMC sub-model dynamic and user-centric, which ensures continuous management of change and a permanent connection between user and provider.

5.3.4.3 Activities and input/output streams within the value proposition component

Value proposition is founded on business model theory and solution marketing. It contributes to a user-centric, dynamic BMC as shown in chapter 5.3.3.3. According to the business model configuration presented in this dissertation, value proposition defines user segments, proposed benefits, and the market offering's specifications.[633] Further requirements are needed for user-centric, dynamic value proposition: a user-centric market segmentation for solutions, a solution that is customized, and a combination of products and/or services for individual or a set of users (Table 8).

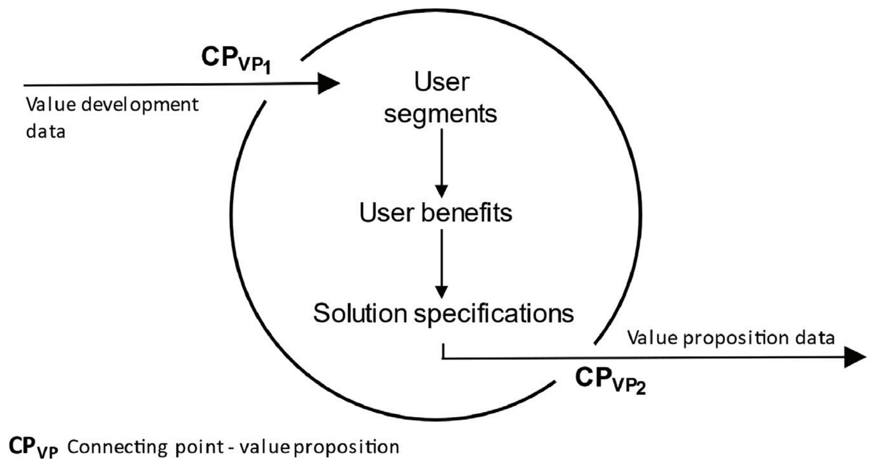

Figure 38: The value proposition component.

At connecting point CP_{VP1} an **input stream of value development data** passes into the value proposition component. This contains user profiles and information about the type and form of possible alterations to the business model (Figure 37). These data inputs (value development data, Figure 37) are a product of business model change which is a part of the value development activities described in chapter 5.3.4.2.

User segmentation activities are an essential part of value proposition. User segments are the basis for an adequate offering for diverse users. As described in chapter 3.3.1.3, marketing literature has examined market segmentation approaches that use different segmentation criteria (such as geographical, demographic, and consumption factors). User benefit-oriented and user needs-oriented segmentation methods have been established since 1968, when Haley offered the benefit segmentation as an alternative approach.[634] Within a user needs-oriented or user benefit-oriented segmentation method, users seeking the same needs or benefits form a market segment.

[633] See chapter 3.1.2 for business model components and underlying elements.

[634] Haley first mentioned the benefit segmentation theory in his unpublished paper 'Experimental Research on Attitudes Toward Shampoos' from February 1961. Refer to Haley 1961, 1968, 31.

In the behavioral customer model,[635] user needs (such as comfort or safety) are part of user profile data. Tina Reichardt described a user needs-oriented market segmentation method for technological innovations. She defined benefits as the perceived or fulfilled level of needs satisfaction.[636] She concluded that a higher needs satisfaction is achieved by matching product attributes (such as brightness-enhancing ingredients in a toothpaste) to the user's need (such as a desire for attractiveness). According to Reichardt's logic, a user's need for attractiveness is accompanied by the realized or perceived degree of how much this need is satisfied (i.e. feeling attractive). Von Berg and Graff followed the logic of Reichardt's needs-oriented segmentation approach, but added socio-demographic and psychographic criteria to their survey design.[637] This user-centric, mixed-crietria segmentation approach (which is used in this dissertation) enriches user need-based segments with multiple user data. The objective is to create user segments with homogenous characteristics in one segment but that are clustered heterogeneously (Figure 39). Because of big data analytics and associated technologies, diverse profile and usage data can create a user-centric, mixed-criteria segmentation.[638]

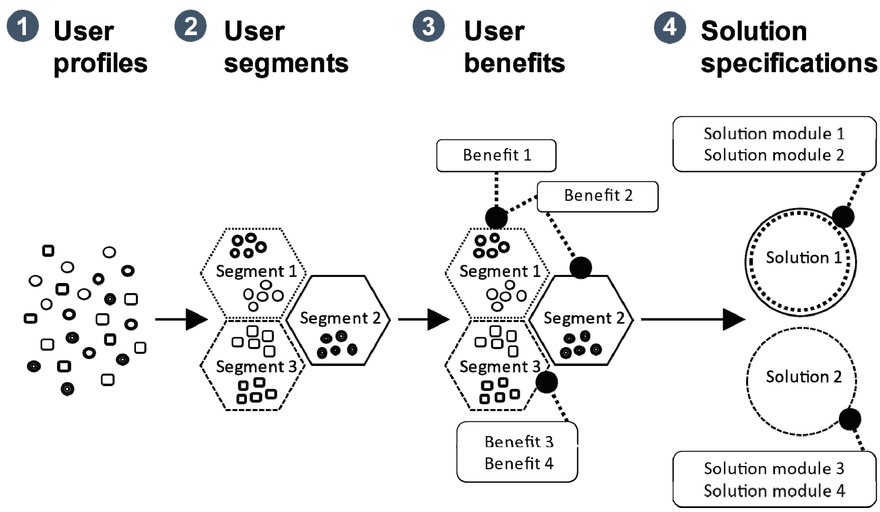

Figure 39: Activities within the value proposition component.

[635] See chapter 3.3.1.4.

[636] Refer to Reichardt 2008, 80–81.

[637] Refer to chapter 3.3.1.3; von Berg and Graff 2016, 46.

[638] See chapter 3.3.1.3, and Figure 18 in particular.

After the user segments are determined, the provider must define the **user benefits** for each segment.[639] The user benefit is deduced from user information stored in the user segments (Figure 39). The overall objective is to match the user benefits proposed by the provider with the benefits perceived by the user segment.[640]

As displayed in Figure 39, user benefits provide the basis for **solution specifications.** Solution specification must fulfil user needs or solve user problems and match the benefits proposed by the provider with the benefits perceived by the user.[641] Solutions integrate products and/or services to create surplus value for the user, where the final offering has more value than the sum of its parts.[642] User segments and user benefits vary, so in some cases several solutions are needed; but sometimes one solution may serve different user segments (Figure 39). The solutions are built on a modular architecture for the sake of flexibility and cost control. Individual modules can be changed or easily replaced by new modules. [643]

For example, a user seeking beauty primarily perceives the benefit of feeling attractive. A provider of teeth whitening toothpaste may offer a suitable solution by offering a mobile application (mobile app) for smartphones and tablets that detects the color of teeth and registers a personal profile with individual goals and photos. Throughout the treatment with tooth whitening paste, the user consistently checks in to the mobile app to track their progress. The mobile app reassures the user that they have received the benefit (i.e. their teeth are whiter) and the provider can offer other solutions, such as a discount for professional teeth cleaning, beauty treatments, that can be booked locally or direct electronic commerce of beauty products. These extensions add surplus value and increase the level of customization.[644] These added services must be integrated into the solution, e.g. by incorporating them into the mobile app's progress tracker.[645] Modularization ensures the solution remains adjustable.[646]

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[639] See chapter 3.3.1.3, particularly Figure 18.

[640] Refer to Skarp and Gadde 2008, 726; Tan 2010, 37; Kowalkowski 2011, 286.

[641] Refer to Skarp and Gadde 2008, 726; Nordin and Kowalkowski 2010, 451–452; Tan 2010, 37; Kowalkowski 2011, 286.

[642] Refer to Vandermerwe and Rada 1988, 315–317; Davies et al. 2001, 7; Sawhney 2006, 8; Pawar et al. 2009, 474–475.

[643] Refer to Windahl et al. 2004, 227.

[644] Refer to Hax and Wilde II 1999, 13; Foote et al. 2001, 92; Miller et al. 2002, 3; Sawhney 2006, 9–10.

[645] Refer to Meier and Uhlmann 2012, 4–6.

[646] Refer to Windahl et al. 2004, 227.

Value proposition data

- User segments
- User benefits
- Solution specifications

Figure 40: Value proposition data.

Within the value proposition component, the provider has done the following:

- Assembled user segments that will be targeted
- Defined user benefits that will be proposed to the user segments
- Specified the solutions that will be offered.

This information provides the **output stream of value proposition data** (Figure 40), which leaves the provider-sided component at connecting point **CP**$_{\mathbf{VP2}}$ (Figure 38).

The activities mentioned above are **abstract steps of business model design procedure**. Depending on the maturity of the business model design, they allow the business model to be conceived, tested, or integrated.[647] *Ideation* activities within value proposition produce user segments, user benefits, and corresponding solution specifications. Potential gaps (e.g. perceived user benefits vs. proposed user benefits) should be closed, and design ideas to close these gaps are created using creativity techniques.[648] *Prototyping* requires detailed business model configurations. These elaborate business models are further refined and evaluated during prototyping within the user phase.[649] *Integration* into value proposition includes the refinement of user segments, user benefits, and corresponding solution specifications, [650] and concludes the business model design procedure. If diverse business model options are conceived, the final alternative is selected as an integration activity.[651] Furthermore, the internal fit (i.e. consistency be-

[647] See chapter 3.2.4.3 for business model design activities.

[648] Refer to Schallmo 2013a, 157–164; Mezger 2018, 110–117; Wirtz 2018, 267–270 for creativity techniques.

[649] Refer to Osterwalder and Pigneur 2010, 254–255; Amit and Zott 2015, 9–10; Wirtz 2018, 274–275. Schallmo provides an exhaustive review of business model prototyping from design to extension and evaluation of prototypes. Refer to Schallmo 2013a, 190–204. Gassmann et al. are the only authors to assign the prototyping phase to implementation activities. Refer to Gassmann et al. 2017b, 66–69.

[650] Refer to Schallmo 2013a, 148

[651] Refer to Osterwalder and Pigneur 2010, 254–255; Wirtz 2018, 240–279.

tween user segments, user benefits and solution specifications) is the focus of attention.[652]

As shown above, ideation begins with value development data (Figure 37). Depending on the type of business model change, the value proposition alterations required can be small or broad. For example, if a business model needs to be innovated, value proposition must be designed from scratch. The ideation, prototyping and integration of user segments, user benefits, and solution specifications will take considerably longer than minor adaptations (such as adding a new solution specification that goes along with the installed user segments and benefits) would.

The following chapter describes the process of value creation and distribution and clarifies the implementation of value proposition into a market ready solution.

5.3.4.4 Activities and input/output streams within the value creation and distribution component

The value creation and distribution component specifies abstract steps in business model design that are required to create a marketable solution. Its configuration strongly relies on business model and network theory (Table 8).

In *business model theory*, value creation and distribution is a business model component.[653] It contains the logic, creation, and distribution of value within a value network.[654] The value network is made up of assets, deliverables, roles, and transactions, and negotiable value is the network's currency.[655] *Network theory* designs value creation and distribution. Value networks rely on dynamic exchanges of tangible and intangible values between their network partners.[656] Value co-creation, a unifying network vision, collective competition,[657] limited internal rivalry, strong core leadership, and limited group sizes are central.[658]

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[652] Refer to Frankenberger et al. 2013a, 265–267.

[653] See chapter 3.1.2 for this dissertation's business model configuration.

[654] Refer to Bieger and Reinhold 2011.

[655] Refer to Norman and Ramirez 1993, 69–70; Allee 2000, 37; Gomes-Casseres 2003, 328–332; Vanhaverbeke and Cloodt 2006, 259–274; Allee 2008, 9–14; Wirtz 2013, 97.

[656] Refer to Allee 2009, 429.

[657] Collective competition stands in contrast to firm-level competition and describes a case where an offering that is co-created within a value network competes with similar offerings in the market, Gomes-Casseres 2003, 329–320.

[658] Refer to Norman and Ramirez 1993, 66; Gomes-Casseres 2003, 331; Vanhaverbeke and Cloodt 2006, 266–277; Wirtz 2013, 94.

To produce user-centric value and distribution, the user must co-create value with their network partners. The network contains cooperating partners that create and distribute joint value.[659] The value network creates joint value by redefining roles and relationships over time instead of adding value chronologically. Moreover, user roles can change too since they co-create value within the value network. Changes in network activities can adapt the solution to changing user demands.[660]

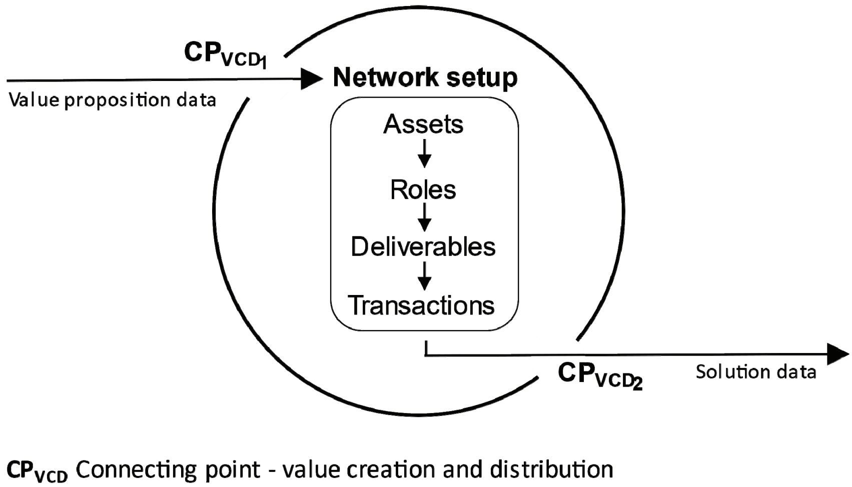

Figure 41: The value creation and distribution component.

Figure 41 illustrates the activities within the value creation and distribution component. At connecting point CP_{VCD1} an **input stream of value proposition data** passes into the value creation and distribution component. This information on targeted market segments, user benefits, and solution specifications build the foundation for these activities.

The **network setup** describes the formation of a new value network or the minor evolution/adaptation of an existing value network. The focal firm orchestrates the changes, acquires and bonds the network partners, bundles resources and capabilities, and manages contractual agreements. However, the focal firm does not necessarily produce the most joint value.[661] Allee separated value network configuration into four steps: defining required assets, determining roles, forming deliverables, and setting transac-

[659] Norman and Ramirez 1993, 66; Vanhaverbeke and Cloodt 2006, 266; Wirtz 2013, 94.
[660] Refer to Norman and Ramirez 1993, 66; Vanhaverbeke and Cloodt 2006, 266; Wirtz 2013, 94.
[661] Refer to Gomes-Casseres 2003, 332; Vanhaverbeke and Cloodt 2006, 270.

tions.[662] Allee explained that the players in a value network, "[…] either individually or collectively, utilize their tangible and intangible asset base by assuming or creating roles that convert those assets into more negotiable forms of value that can be delivered to other roles through the execution of a transaction."[663]

To meet solution specifications developed in the BMC sub-model component, adequate **assets** for solution configuration must be chosen. *Tangible* or *financial* assets include goods, services, and revenue. *Intangible* or *non-financial* assets include knowledge, information, customer loyalty, and internal structures. The focal firm chooses relevant partners who bring their tangible and/or intangible assets to the value network.[664] The accumulation of assets is not sufficient to create a value network. Management, combination, and application of these tangible and intangible assets is needed to provide a marketable solution.[665]

In general, **roles** describe how people or groups engage in and add value to activities. Within a value network, roles manage the tangible and intangible assets they supply, which in turn allows the role to be executed. These resources are actively processed into an output value or used as an input to their asset base from other network partners.[666] Roles are performed by "[…] individuals; small groups or teams; business units, whole organizations; collectives, such as business webs or industry groups; communities; or even nation states […]"[667]. However, roles in a value network are usually not the same as roles in a single firm. Moreover, roles in a network are new and activity-based, i.e. they reflect different activities.[668] The value network is built on different roles (such as the focal firm, suppliers, complementors, investors, distributors, strategic business partners, and users) that cooperate in different ways (such as contracting, joint ventures, and acquisitions).[669] Network participants play certain roles, make decisions, add

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[662] Refer to Allee 2009, 430.
[663] Allee 2008, 9.
[664] Refer to Allee 2000, 37.
[665] Refer to Vanhaverbeke and Cloodt 2006, 266.
[666] Refer to Allee 2008, 12–14, 2009, 429.
[667] Allee 2008, 14.
[668] Refer to Allee 2008, 12.
[669] Refer to Gomes-Casseres 2003, 328; Vanhaverbeke and Cloodt 2006, 259–274; Allee 2008, 6–14; Wirtz 2013, 97.

value, and interact with one another based on the assets they possess. But before they can interact, their assets must be transformed into deliverable value.[670]

Deliverables are what can be exchanged between network partners. Network players create deliverables by themselves or in collaboration with other network participants. They utilize their asset base and their individual network role to generate deliverable value.[671] Deliverables can be *physical* (e.g. tangible product, document) or *non-physical* (e.g. verbally delivered message, request). Knowledge and information are principally non-physical and are condensed into a report that can be transformed into physical deliverables.[672]

Deliverables can be distinguished by their contractual form. *Tangible* or *contractual* deliverables "[…] include anything that is contracted, mandated or expected by the recipient as part of the delivery of a product or service and that directly generates revenue […]"[673]. These encompass goods, services, revenue, and any contractual activity (e.g. invoices, receipts of orders, requests for proposals, payments). The physical or non-physical nature of a deliverable does not determine whether it is tangible or intangible. If it generates revenue, is part of a contract, and is paid for, then it is tangible. Therefore, knowledge (such as reports or package inserts) is a tangible deliverable because it is contractual.[674]

Intangible deliverables "[…] include all unpaid or non-contractual activities that make things work smoothly and help build relationships."[675] These informal, rarely discussed, and negotiated pieces of knowledge include strategic information, technical/process/planning knowledge, usage data, and collaborative design. Favors and advantages are also intangible benefits and can be traded for one another.[676] Deliverables are the outputs of *value conversion*; a process where financial and non-financial assets are converted into more negotiable tangible or intangible deliverables. For instance, goods and services (financial assets) are utilized and converted into units that can be traded for money or other measurable exchanges (tangible deliverables). On the

[670] Refer to Allee 2008, 14.
[671] Refer to Allee 2008, 14, 2009, 430.
[672] Refer to Allee 2008, 14.
[673] Allee 2008, 7.
[674] Refer to Allee 2008, 11.
[675] Allee 2008, 7.
[676] Refer to Allee 2008, 11.

other hand, knowledge (a non-financial asset) can be converted twofold. It can be offered or sold in a report or workshop format to become a tangible deliverable. When offered as a favor, such as a free advice, it becomes an intangible deliverable. This value conversion process also works the other way around when a deliverable is exchanged for another deliverable and becomes a new asset for the receiver. Conversion of tangible or intangible deliverables into financial or non-financial deliverables creates new assets. For instance, any revenue can be converted to a financial asset. For this purpose, a net of transactions must be determined to display and manage these various exchanges within the value network.[677]

Transactions describe exchange within the value network. The direction of exchange determines who is the sender and who is the recipient. Exchange of tangible or contractual deliverables differs from the exchange of intangible deliverables, such as non-contractual information, favors, and advantages.[678] Revenue is a financial deliverable, but differs depending on the transaction. The types of revenue are: direct, indirect, transaction-dependent, and transaction-independent.[679] Transaction-dependent revenues (e.g. transaction revenue, usage fee, commission) are exchanged for a product or service that is sold for money or another measurable exchange. Transaction-independent revenues are not linked to the transaction's time, frequency or length, but are charged for periodically (monthly fee). Direct revenues are fees and transaction revenue for products and services, and indirect revenues include commissions, advertising, data mining, and sponsorship.[680]

Transactions reflect the types and number of exchanged deliverables, so specify the *distribution of value* within the network. The focal firm tries to guarantee that every network player benefits from being a member of the value network because the constellation's resilience and success is affected by "[…] the commitment of the different partners in the value constellation."[681] Moreover, a unifying vision, limited internal rivalry, strong core leadership, and limited group sizes ensure a functioning network structure and fair value distribution.[682] However, how much joint-value a network partner can

[677] Refer to Allee 2008, 8–9.
[678] Refer to Allee 2008, 14.
[679] See chapter 3.1.2, Table 2 in particular for the classification of revenue streams.
[680] Refer to Wirtz 2013, 142.
[681] Vanhaverbeke and Cloodt 2006, 267.
[682] Refer to Gomes-Casseres 2003, 331.

claim depends on the firm's bargaining power and their position within the network. Bargaining power is mainly determined by the network player's assets – assets that are scarce, valued, and well-protected give more bargaining power. Competition between the firm's suppliers and/or complementors can also increase bargaining power, as can a lack of competition between the firm and its partners. The firm has a structural advantage if it has a central position in the network (e.g. focal firm), occupies structural holes, or participates in multiple value constellations.[683]

The following example of a **network setup** for a dental care solution is simplified and fictional (Figure 42), but was inspired by a solution offering from Procter & Gamble: the Oral-B Genius 8000 electric toothbrush. This product combines an electric toothbrush and a toothbrush travel case with an integrated smartphone charger and other services that allow the provider to monitor the use process in real time at the PoU. Position detection technology and a pressure sensor allow the toothbrush to measure the brush head's position and pressure during toothbrushing. These data are sent to a mobile app via Bluetooth and the user can see on the smartphone screen where they are brushing. This gives the user real-time feedback, allowing them to adjust their brushing process accordingly. The user can also individualize their brushing plans according to their individual preferences (e.g. fresh breath, whitening, gum health).[684]

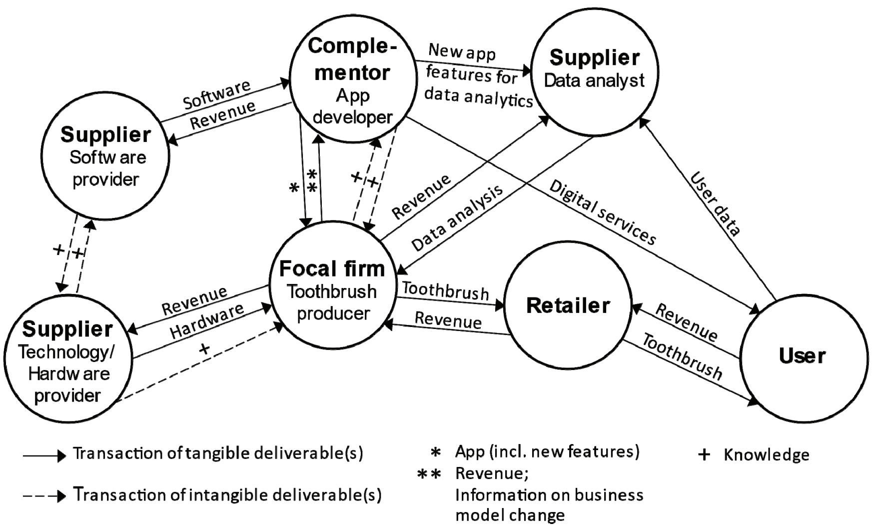

Figure 42: An example network setup for a dental care solution.

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[683] Refer to Gomes-Casseres 2003, 332–333.

[684] Refer to Procter & Gamble 2019.

Adapted from Allee 2009, 435–437.

This network setup (Figure 42) comprises the focal firm (toothbrush producer), a complementor (mobile app developer), three suppliers (hardware and software provider, data analyst), a retailer, and the user. The retailer and user comprise a network of retailers or a user segment. The solid lines indicate a transaction of tangible deliverables, and dashed lines indicate the transaction of intangible deliverables. The toothbrush producer needs hardware, such as a pressure sensor, to design an intelligent toothbrush that interacts with its environment. The manufacturer exchanges these technologies for direct, transaction-based revenue (e.g. bank transfer) with a hardware supplier. Moreover, the hardware supplier gives free advice and individualized strategic information to the toothbrush manufacturer whenever a new technology emerges that may enhance the value of the dental care solution. For this purpose, the hardware and software supplier also exchange free information and knowledge on technology evolution as well as advice on hardware and software products. The software provider supplies the mobile app developer with specific software in exchange for direct and transaction-independent revenue (yearly software license). The mobile app developer develops and operates the app for the toothbrush producer in return for direct, transaction-independent revenue (yearly fee). The toothbrush producer distributes the dental care solution to a retailer network and charges an indirect, transaction-dependent commission. These retailers sell the dental care solution to the user for direct, transaction-dependent revenue (e.g. payment in cash, PayPal transfer). The user receives mobile app-based services (personalized tooth brushing, real-time feedback on tooth brushing) from the mobile app developer and sends profile and usage data including individual feedback to the data analyst. User data are tangible deliverables, since they are essential for the mobile app services. Therefore, the user is integrated into the value network and acts as a co-creator of value. The user data are analyzed and the results (e.g. use frequencies of services) are reported to the toothbrush manufacturer who exchanges this information for direct, transaction-independent revenue (monthly fee). Based on these data, the toothbrush manufacturer can initiate business model change if necessary. The complementor receives information on business model changes so they can adapt their mobile app service as needed. In turn, the mobile app developer sends information on new mobile app features to the focal firm and opportunities for further data analytics to the data analyst. As part of the contract, these two players exchange knowledge and relevant information on software and big data analytics to successfully realize the digital part of the solution offering.

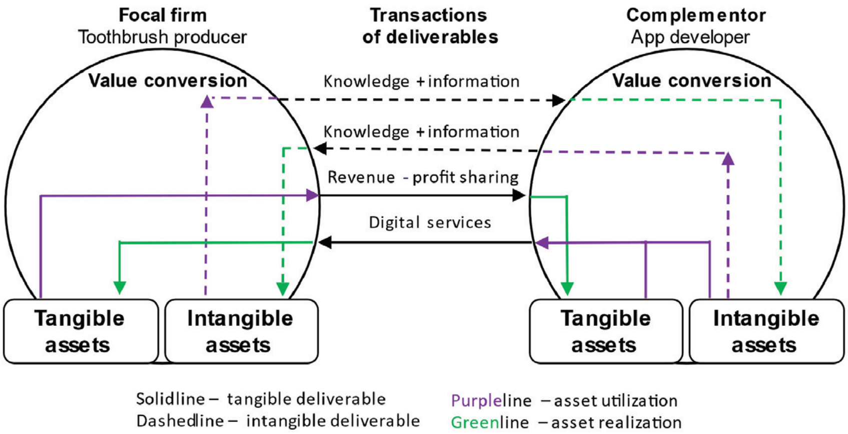

Figure 43: Example of value conversion process.

To explain the entire **value conversion process**, the transactions between the toothbrush manufacturer and the complementor are described in Figure 43. These two partners have a central position within the network because they supply the solution's main components: an intelligent toothbrush and a corresponding mobile app. The mobile app developer uses their tangible assets (existing code, software) and intangible assets (human competence and developer skills) to provide a tangible deliverable: a mobile app-based digital service. These services are custom-built for the product (the electric toothbrush). In exchange for these services, the toothbrush manufacturer sends direct, transaction-based revenue (profit sharing). The toothbrush producer realizes a new tangible asset when they integrate the mobile app into the network's solution. The two partners also exchange intangible deliverables (free knowledge and information), such as advice on research and development processes, new solution ideas, strategic decisions, and best practices.

The network setup determines the structure and processes within the network, providing the foundation for value creation and distribution. When the logic of value creation and distribution is specified, value conversion ensures the assembly and manufacture of solutions.[685] At connecting point CP_{VCD2} the **output stream of solution data** exit and go

[685] Refer to Allee 2008, 9–10; Hakanen and Jaakkola 2012, 594.

back to the value development component (Figure 41). The output stream contains information about the solution (data on value proposition, value creation, and distribution, Figure 36).

A value network is set up through **abstract steps during business model design procedure**. These steps ideate the business model or alter/integrate an existing business model; ideation might be skipped if the business model is already mature and only small alterations are necessary.[686] *Ideation* during value creation and distribution is the initial network setup. Potential gaps are identified and design ideas are made to close these gaps by means of, for example, creativity techniques.[687] Prototyping creates detailed business model configurations which are further refined and evaluated during prototyping within the user phase.[688] *Integration* into value creation and distribution includes refining the value network setup.[689] This concludes business model design. If there are different business model options to choose from, the final choice is selected as part of the integration process.[690] The internal fit (i.e. consistency between resources, roles, relationships, and transactions) is also examined in detail.[691]

Ideation within the value creation and distribution component is enabled by value proposition data (Figure 40). Depending on the type of business model change, alterations in value creation and distribution can be small or broad. For example, if a business model evolves, then value creation and distribution will change slightly. These alterations might only affect cooperation within the value network, e.g. if a former contractor becomes a partner in a joint venture.

5.4 Modeled instance of the BMC

The modeled instance of the BMC is an operative business process (i.e. a business process diagram). It illustrates the process of business model design and change and its specific activities. The modeled instance can be applied to digitalized business mod-

[686] See chapter 3.2.4.3 for business model design activities.

[687] Refer to Schallmo 2013a, 157–164; Mezger 2018, 110–117; Wirtz 2018, 267–270 for creativity techniques.

[688] Refer to Osterwalder and Pigneur 2010, 254–255; Amit and Zott 2015, 9–10; Wirtz 2018, 274–275. Schallmo provides an exhaustive review of business model prototyping from design to extension and evaluation of prototypes. Refer to Schallmo 2013a, 190–204. Gassmann et al. are the only authors to assign the prototyping phase to implementation activities. Refer to Gassmann et al. 2017b, 66–69.

[689] Refer to Schallmo 2013a, 148

[690] Refer to Osterwalder and Pigneur 2010, 254–255; Wirtz 2018, 240–279.

[691] Refer to Frankenberger et al. 2013a, 265–267.

els in every industry.[692] Business modeling techniques are used to model the process. It does not include components, but describes activities in detail. The modeled instance includes input and output streams between activities as well as start and end events.

5.4.1 Method: Business Process Model and Notation (BPMN)

The Business Process Model and Notation (BPMN) is one of the latest, ISO-standardized tools for process modeling.[693] The flowchart-based notation provides standardized descriptions and graphical representation of processes and process execution in software environments.[694] The following chapters describe BPMN-defined business processes and the corresponding symbol references.

5.4.1.1 BPMN processes

BPMN is used to model business processes in single or network environments. In this dissertation, the latest version (BPMN 2.0, released in 2011) is used.[695] White and Miers postulated that “In BPMN a Process represents what an organization does – its work – in order to accomplish a specific purpose or objective.”[696] How to organize work within an organization raises further questions: which steps are necessary to achieve a certain goal?; who (in-house/outsourced) is in charge of which step and by means of which resources?; how should these steps be executed?; and how will results be monitored?[697]

Process modeling facilitates communication inside and across enterprise borders. A standardized notation can be understood by all involved parties. A modeled process can also drive work itself. This applies to processes that are modelled to be executed in a software system. These automated processes carry instructions and information, and execute tasks automatically. In BPMN, a business process depicts a sequence of business activities and corresponding information. However, the BPMN notation does not describe the purpose or objective of the modeled process. BPMN supports modelers

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[692] Within this dissertation, *digitalized business models* are understood as business models that incorporate technical facilities for a digital and interdependent communication and interaction between user and provider. Solutions that are marketed within these types of business models can include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop) as well as digital services (e.g. providing car software download for autonomous driving).

[693] Refer to Gadatsch 2017, 112.

[694] Refer to White and Miers 2008, 23.

[695] Formerly ‘Business Process Modeling Notation’. Refer to White and Bock 2012, 17–18.

[696] White and Miers 2008, 23.

[697] Refer to White and Miers 2008, 19.

with everything from simple process maps (activities, conditions, workflow) or detailed process descriptions (roles, data, information) to fully executable process models for analysis and simulation.[698]

BPMN differentiates between three processes: orchestration, collaboration, and choreography. **Orchestration** (Figure 44) displays the activities and workflow of a single business, organization, person, engine, or other entity. The process is modeled from a single coordinating perspective and references to its missing or limited view of other external processes. As shown in Figure 44, orchestration is contained within a pool. In this example, lanes subdivide the provider's process objects into two business units. All process elements inside the pool have access to the same data.[699]

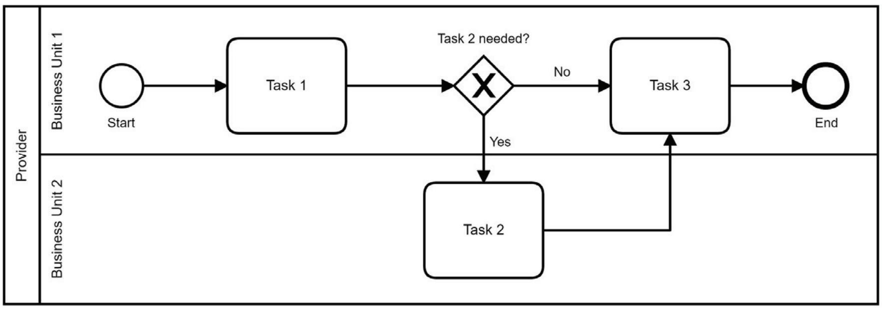

Figure 44: BPMN 2.0 orchestration process.

In BPMN, collaboration and choreography processes are **interaction models** that interact and communicate between two or more participants (e.g. businesses, people, automated software agents). Interaction diagrams often do not reveal business internals in detail but enhance the business process elements essential for interaction (e.g. messages). Participants interact by sending messages to each other. Messages are either informational (e.g. email, mobile app message) or physical (e.g. cars, tickets).[700] Figure 45 illustrates the differences between collaboration and choreography processes.

[698] Refer to White and Miers 2008, 20–23; White and Bock 2012, 17.
[699] Refer to White and Miers 2008, 29–30.
[700] Refer to Bock and White 2012, 32–33.

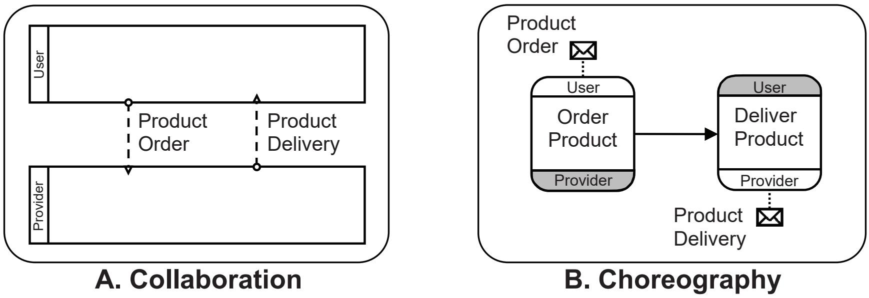

Figure 45: BPMN 2.0 collaboration and choreography processes.
Adapted from Bock and White 2012, 33.

In a **collaboration** process, participants are represented by rectangular pools containing distinct processes. In Figure 45 (left side), participants are shown within a black box and their internal processes are all hidden. Modelers can also use a grey or a white box. White boxes represent a participant's orchestration process and expose detailed internals. A grey box shows fewer details of internals and is usually chosen if participants are separate and have no knowledge of their partner's processes. Message flow between participants is shown as dashed arrows with a label, and these message flows connect to the pool boundaries. In a white box pool, message flows are connected directly to process elements. The message flow goes from left to right; the user (sender) sends an order to the provider (recipient) and the provider (sender) delivers the ordered product to the user (receiver). In collaboration processes, the participants and their internal processes (where applicable) stand out. This process type stresses the relationships between participants.[701]

The **choreography** process contains a sequence of choreographed activities (rounded rectangles). Participants are presented as bands within the activities, senders as white bands, and receivers as grey bands. Messages are displayed as envelopes with name labels connected with a dashed line to the sender. The message flow (solid arrow) between the two activities determines the order of messages (which is the same as the message flow in the collaboration process). A choreography activity must also contain the message sender from the following activity (either as sender or recipient). Choreography processes work well if emphasis is put on the order of interactions between par-

[701] Refer to White and Miers 2008, 65;173.

ticipants (sequence flow) rather than internal processes and relationships between participants.[702]

In BPMN, business processes:

(1) depict a **sequence of business activities** and corresponding information
(2) and can be modeled as an **orchestration**,
(3) **collaboration**, or
(4) **choreography** process.

The following chapter describes the BPMN symbol references and explains the function of graphical elements within this process modeling technique.

5.4.1.2 BPMN symbol reference

BPMN applies the flowcharting technique as well as the underlying **token** mechanism. A theoretical token travels along the sequence flow and passes through graphical elements. The sequence flow determines the order of flow objects (e.g. activities, events) in a process. Every token that travels along the sequence flow represents a process **instance**.[703]

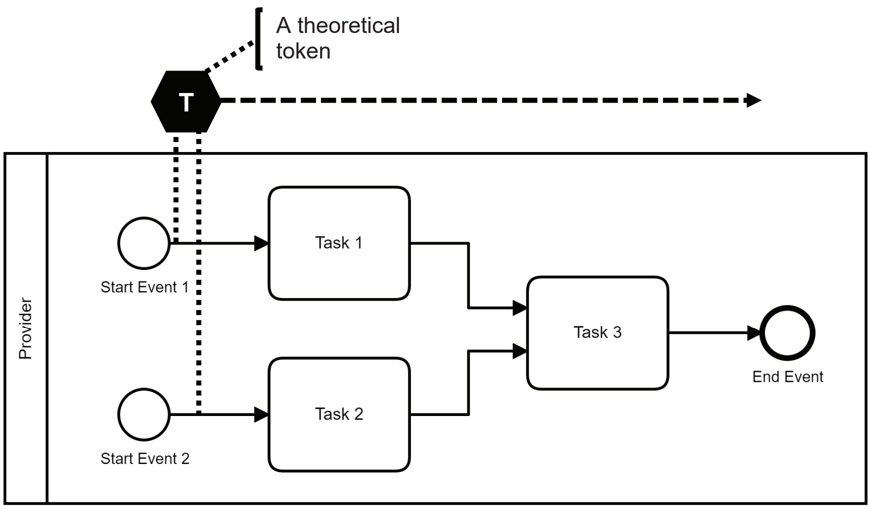

Figure 46: BPMN 2.0 token and instances.
Adapted from White and Miers 2008, 66.

[702] Refer to Bock and White 2012, 33–37.
[703] Refer to White and Miers 2008, 65–66, 95.

Figure 46 shows an orchestration process with two distinct start events that lead to a different sequence of activities. Since the start events are independent from each other, the process starts (token travels along sequence flow) if any of them is triggered. In BPMN, any process can have multiple instances active at the same time. For example, if a 'Start Event 1', a 'Start Event 2' and yet another 'Start Event 1' are triggered one after the other, three instances of the process are created, and three tokens travel along the sequence flow. Depending on starting times, all three process instances can be active at the same time. In any case, the process is performed three times.[704]

BPMN uses four categories of basic graphical elements:[705] flow objects, connecting objects, artifacts, and swimlanes. In BPMN 2.0, **flow objects** as shown in Figure 47 include events, activities, gateways, and data. An *event* is represented by a circle and occurs during a business process. The open center of BPMN events can contain a trigger symbol which describes a specific circumstance (e.g. the envelope symbol represents the arrival or sending of a message). Any event impacts the sequence flow and starts, interrupts, delays or ends a process. *Start events* (single thin line) trigger the process to start, *end events* (single thick line) indicate a process result. *Intermediate events* (double thin line) occur after the start but before the end of a process. Intermediate events either catch or throw an event. The *catching intermediate event* interrupts (and sometimes delays) the sequence flow until a specific circumstance arises, e.g. a specific message has arrived. Hence, catching intermediate events react to a trigger (arrival of message) before the token is able to travel along the sequence flow. When the process token arrives at a *throwing intermediate event*, the event instantly creates a trigger itself, e.g. sending a message. Intermediate throwing events do not delay the process.[706] *Intermediate boundary events* (not shown in Figure 47) are always attached to the lower right corner of an activity's boundary. Once the boundary event catches a trigger (e.g. catches a signal), it either interrupts or does not interrupt the activity to which it is attached. The latter is represented by dashed double lines for its circle border. This non-interrupting boundary event creates a new token, and with it a parallel outgoing sequence flow; the source activity is not interrupted. The process continues on

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[704] Refer to White and Miers 2008, 65–66, 95.

[705] BPMN 1.x and 2.0 include many variations of graphical elements within the basic categories. Since the BMC can be modeled with a basic set of elements, the more advanced variations are not explained in this chapter. For a detailed overview of graphic elements refer to White 2006; White and Miers 2008; White and Bock 2012.

[706] Refer to White 2006, 2; White and Miers 2008, 87–135.

both outgoing sequence flows. On the other hand, the interrupting boundary event interrupts the source activity and the process solely continues on sequence flow which emanates from the boundary event.[707]

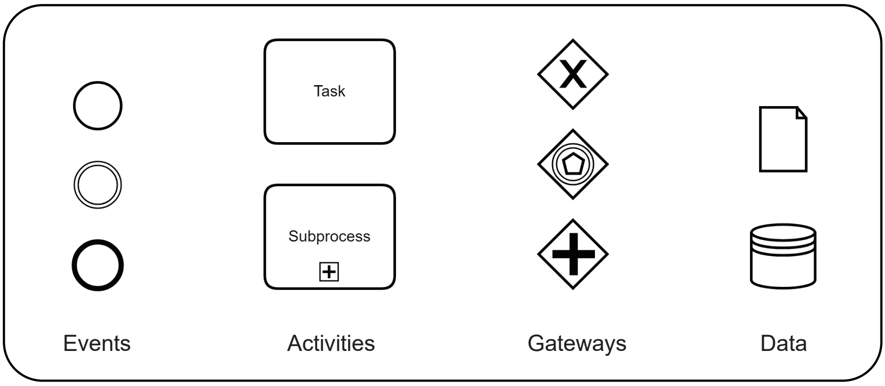

Figure 47: Selection of BPMN 2.0 flow objects.

Activities are shown as rounded-corner rectangles (Figure 47) and generally represent the process participant's work. When the process token arrives at an activity it changes to an active state and a new activity instance is created. When all necessary inputs (e.g. data) are provided, the activity is performed. After completion, the token moves along the outgoing sequence flow. The performance of activities takes up varying amounts of time and typically involves inputs from different resources to generate an output. BPMN distinguishes between atomic activities (*tasks*) and compound ones (*subprocesses*). The latter enables the modeler to show another process level in greater detail.[708]

Diamond-shaped *gateways* control and impact the sequence flow by splitting or merging the path. There are three core gateways (Figure 47):[709] exclusive, event and parallel. The *exclusive gateway* splits the path into a variable number of outgoing sequence flows. The gateway models a decision and the options are exclusive, i.e. only one outgoing sequence flow evaluates to true. This path is selected to continue the process. When several incoming sequence flows are merged through one exclusive gateway, any token is simply passed through and continues to flow down the merged outgoing path. The *event gateway* also splits the process path into two or more outgoing sequence flows. The gateway supports decision making based on the occurrence of spe-

[707] Refer to White and Bock 2012, 22–24.

[708] Refer to White 2006, 2; White and Miers 2008, 67–74.

[709] Apart from the core gateways, there exist more advanced gateway variations which are explained by White and Miers 2008, 138 and for BPMN 2.0 by White and Bock 2012, 24–25.

cific events. Every outgoing path is equipped with a catching intermediate event. If one of these events is triggered, the process continues exclusively down this path. When several incoming sequence flows are merged through an event gateway, any token is simply passed through and continues to flow down the merged outgoing path. The *parallel gateway* sends the token down every outgoing sequence flow simultaneously. A merging parallel gateway waits until every token from the various incoming sequence flows has arrived to send one token down the one outgoing sequence flow. *Data* contain data objects (regular, input, output) and data stores. Data objects are connected to activities or events through data associations (Figure 48). Data stores are represented by a database cylinder shape and include data stores, repositories, and databases. Linked to a process activity, data stores show the interaction of stored data with specific activities.[710]

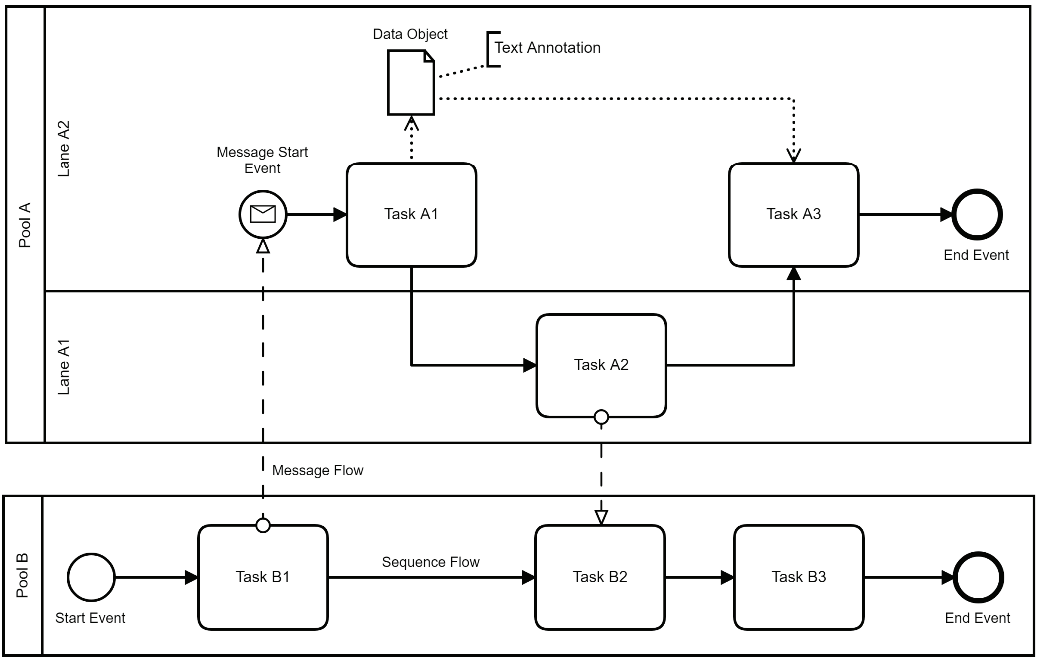

Figure 48: BPMN 2.0 connecting objects, artifacts and swimlanes.

Figure 48 illustrates a collaboration process with two participants in white box pools whose internal orchestration processes are revealed. The modeled process shows examples of three basic graphical element categories: connecting objects, artifacts, and

[710] Refer to White 2006, 2; White and Miers 2008, 137–138; White and Bock 2012, 25–27.

swimlanes. In BPMN, **connecting objects** refer to the *sequence flow* (solid line with solid arrowhead), the m*essage flow* (dashed line with open arrowhead) or an *association* (dotted line or dotted line with line arrowhead). Whereas the sequence flow determines the order of flow objects in a business process, the message flow displays the communication between process participants that send messages to each other. An association connects artifacts (e.g. data) or annotations to other graphical objects in the process. **Artifacts** include further information about the process but do not impact its structure or sequence flow. *Text annotations* can be connected to every graphical element in the process and provide further information or notes. Text annotations are connected to objects via associations. **Swimlanes** organize a modeled business process. There are two types of swimlanes: *pools* and *lanes*. Pools contain orchestration processes; in the context of collaboration processes, each pool represents a distinct participant.[711] Lanes divide pools and their process elements into sections. These sub-partitions group related pool objects and can display any desired classification (e.g. roles, departments, products, technology, locations).[712]

The BPMN provides:

(1) **mechanisms** including tokens and instances**,**
(2) **flow objects** including events, activities and gateways,
(3) **connecting objects** including sequence flows, message flows and associations,
(4) **artifacts** including data objects and text annotations as well as
(5) **swimlanes** including pools and lanes

for process modeling.

Within this chapter, the mechanisms and basic categories of graphical BPMN elements are explained to provide a base for process modeling. In the following chapter, this knowledge is applied to model the BMC business process.

5.4.2 Configuration requirements

The BMC is a dynamic, user-centric business model design and change process model. The modeled instance is an operative business process mapped out as a process diagram with detailed and ordered activities and connecting input and output streams. Table 10 shows the configurational requirements of a dynamic, user-centric modeled instance.

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[711] See chapter 5.4.1.1 for BPMN processes.
[712] Refer to White and Miers 2008, 161–184.

Criteria for dynamic, user-centric approach		**BMC modeled instance configuration based on BMC meta-[713] and sub-model[714] configurations and BPMN[715]**
Dynamic[716]	*Continuousness, simultaneousness*	Implementation of two collaboration processes that depict the user and the provider phase. Installation of events that can trigger both processes automatically and independently to enable continuousness and simultaneousness of phases.
	Interdependency	Installation of overarching touch point (e.g. mobile app) as participant in both collaboration processes to guarantee interdependency of phases.
User-centric[717]	***Enabling factors:*** *Organizational integration, data integration*	Implementation of two collaboration processes with overall three participants – user, touch point and provider. Activation of a touch point participant (e.g. mobile app) in an AmI and IoT environment to implement behavioral customer model and enable bilateral communication and interaction between user and provider. Use of business rule tasks (including algorithms) and data objects for data analytics and data integration.
User-centric[718]	***Constituting factors:*** *Bidirectional communication and interaction process, proactive customization; user integration*	

Table 10: Configuration requirements of dynamic, user-centric modeled instance of the BMC.

The **user phase** is depicted in the first collaboration process. This process maps out the interaction and communication between user and touch point. The touch point automatically provides pulled and pushed solutions and solution prototypes, and collects user data by default. The **provider phase** is laid out in the second collaboration process, where touch point and provider interact to design and change the business model.

The BMC involves a data-driven behavioral customer model that enables a relational process between user and provider. The **provider** can directly engage in use processes, e.g. by pushing solutions into the use process or by collecting and analyzing user data. The provider can monitor use processes and events that lead to the use of a solution. These mechanisms of the modeled instance reveal the internals of the user process.

A behavioral customer model which is embedded in a **touch point**[719] and supported by an AmI[720] and IoT[721] environment allows the user to purchase the product and/or ser-

[713] See chapter 5.2 for BMC meta-model.
[714] See chapter 5.3 for BMC sub-model.
[715] See chapter 5.4.1 for BPMN modeling technique.
[716] See chapter 2.1 for constituting factors of dynamic approaches.
[717] See chapter 2.3 for enabling and constituting factors of user centricity.
[718] See chapter 2.3 for enabling and constituting factors of user centricity.

vice without the provider being present. For example, if a purchased car is not connected to the internet, the provider cannot collect usage data and cannot interact with the user during their use process. The same is true for certain services. If a customer uses a public bus, the provider is unable to monitor the use process unless the customer has checked their trip in via a mobile app. Without a relational process between user and provider, the customer use processes would be a black box to the provider and user information feedback would have to be gathered through follow-up customer services only. But user processes are exposed in the modeled instance, so the user pool is a grey box to the provider.

The user interface also enables the **user** to signal user data (e.g. individual demands) to – and pull solutions from – the provider. However, the internals of user data processing and the design or change of the business model remain invisible to the user. The touch point connects user and provider. It is an automated, intermediary digital agent deployed by the provider.

In the next chapters, the BPMN 2.0 **data objects** are modeled. However, data flow at the start or end of every process i.e. input and output data, is not depicted through data objects but through the catching and throwing signal events. To ensure clarity and comprehensibility, user interfaces and databases are not described in the process diagram since almost every workflow object accesses these. Both phases are modeled on the user having access to the touch point, i.e. a user interface (e.g. mobile app), and the provider having access to data on the user interface and database. The use of web services or automated software is indicated through specific tasks and is referred to in the text.

[719] A touch point offers access to a pool of resources (e.g. networks, storage capacity, computing power, software applications) without the need for human interaction between touch point user and touch point provider. Refer to Hentschel and Leyh 2018, 5.

[720] "In an ambient intelligent environment, people are surrounded by networks of embedded intelligent devices that provide ubiquitous information, communication, services, and entertainment. Furthermore, the devices seamlessly adapt themselves to users and even anticipate their needs.", Vasilakos and Pedrycz 2006, 1.

[721] "While there is no universal definition for the IoT, the core concept is that everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to achieve some useful objective.", Whitmore et al. 2015, 261.

5.4.3 Process modelling with BPMN

Within the scope of this chapter, the BMC instance is modeled by the BPMN. To improve clarity and comprehensibility, the user phase and the provider phase are modeled individually.

5.4.3.1 Modeling the user phase

The user phase involves interaction and communication between the user and the touch point. The touch point is as an intermediary digital agent deployed by the provider, and facilitates an automated, relational process between user and provider. The user phase includes the use process, so produces user data (including profile and usage data).[722] With reference to the behavioral customer model and pull-push mechanism,[723] the user can pull the solution from the provider and make specific demands. The touch point can also collect user data during this phase and can push a solution into the use process.[724]

Within the user phase, both **business model design and change activities** take place. The *prototyping* step of business model design can take place when the solution is being used. The modeled instance does not determine whether the used solution is a prototype or a market-ready offering. The gathering and transfer of real-time usage and profile data during the field test such as user feedback (e.g. preferences, problems) help designers to finalize the prototype. This transfer of user data is part of the *observation* step, which is the first activity in business model change procedure.[725]

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[722] See Figure 34 for user data.

[723] See chapters 3.3.1.4 and 5.3.3.1 for the behavioral customer model and the pull-push mechanism.

[724] See Figure 33 for the point of use (PoU).

[725] For this paragraph, see chapter 3.2.4.3 for business model design and 3.2.4.2 for business model change activities.

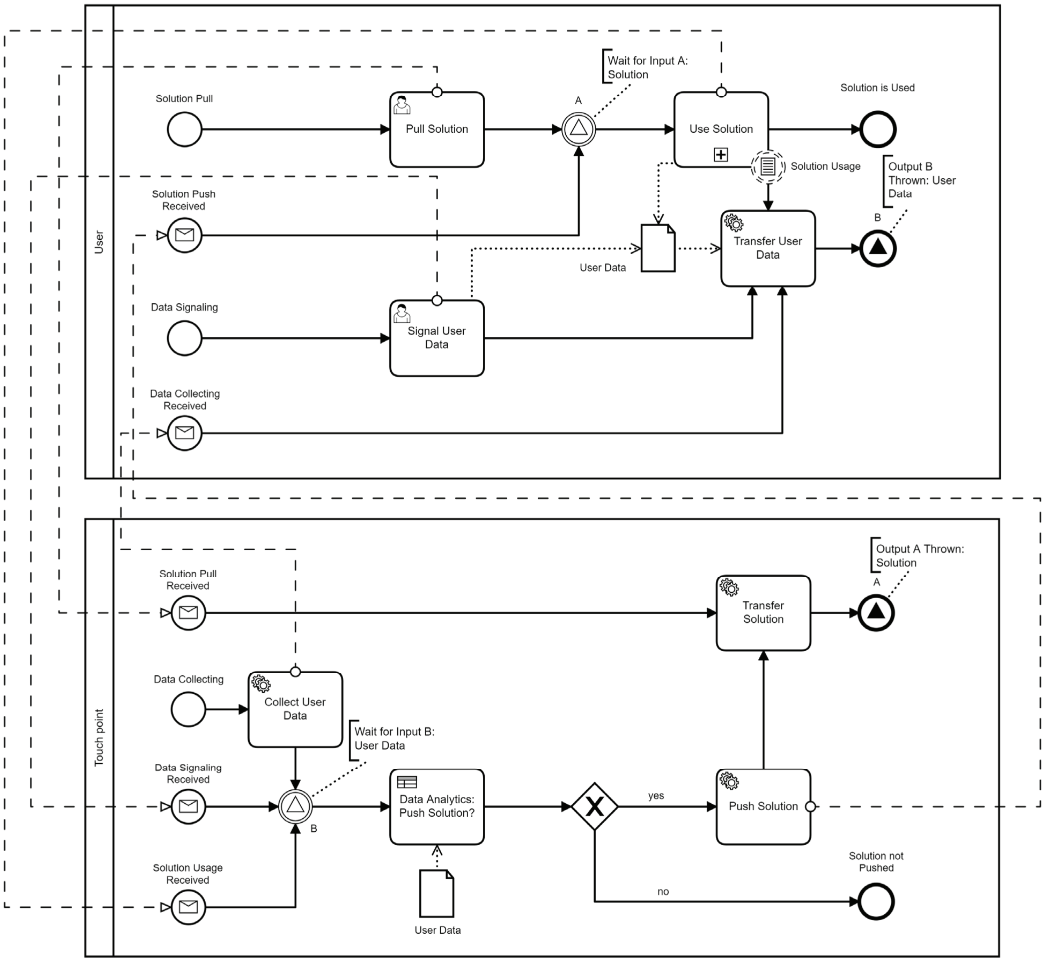

Figure 49: The BMPN-modeled user phase.

Figure 49 illustrates the BPMN 2.0-modeled user phase of the modeled instance of the BMC. According to the behavioral customer model and the pull-push mechanism, three **user activities** exist within the AmI- and IoT- enabled environment: signaling data, pulling solutions, and using solutions. These activities are represented in the user pool by tasks marked with a user symbol in the upper left corner. User tasks are executed by a human with the assistance of a software application, e.g. mobile apps or another user interface.[726] If the user decides to **pull a solution** from the touch point, the user phase begins at the start event (*Solution Pull*). An instance of the BMC process is immediately generated, and a token moves down the sequence flow. The user task (*Pull Solution*) is

[726] Refer to White and Miers 2008, 68.

completed by choosing and requesting a solution from the provided offerings. A message is sent to the touch point pool through a message flow (dashed line with open arrowhead), which requests delivery of the chosen solution. The catching message start event (*Solution Pull Received*) is triggered by the user's request for a solution. The touch point receives the request through the user interface (e.g. digital web services, mobile apps, smart screens, and any IoT-enabled product such as a smart washing machine or a connected car can act as an interface between user and provider).[727] The start event initiates a new instance of the user phase and the token moves down the sequence flow to the service task (*Transfer Solution*), where the **solution is transferred** to the user. The solution can contain intangible and tangible components, such as digital services as well as vehicles, mobility smartcards, etc. This service task may trigger other workflows that are not modeled, such as an internal shipping process (e.g. an electric bicycle is shipped to its new user, the keys for a rental car are handed over, or a digital transportation ticket solution is activated on a smartphone app). The service task is completed once every component of the solution is delivered to the user. The throwing signal end event *A* (indicated by the black triangle) indicates successful solution delivery in the user pool. This ends the process instance within the touch point pool.

As an example, the user may request a digital ticket solution which includes different means of transportation within one region or city. In another scenario, the user might pull a solution that includes the delivery or handover of a tangible product – for example, automotive manufacturer *Audi* launched its 'Audi on demand' service, which provides car rentals on short notice (from one hour up to one month) with fully comprehensive insurance and concierge service.[728] After the request message is sent to the touch point, the token moves down the sequence flow and arrives at the catching intermediate signal event *A* (indicated by the white triangle), which translates to a point in time where the user is waiting for the requested solution offering, i.e. input *A*. The triangle that is embedded into the circular event marks a signal trigger. The event is triggered the moment the requested solution is successfully transferred to the user. The solution is transferred within the touch point pool, but signals are understood as broadcasts from other processes. Hence, orchestration within the touch point pool broadcasts a signal that is

[727] Refer to Thesmann 2016, 1.
[728] Refer to Audi Business Innovation GmbH 2019.

caught by the orchestration process in the user pool.[729] The intermediate event is completed once the digital ticket is activated by the provider and appears on a mobile app or the rental car is delivered to the user by a concierge, and the process token within the user pool continues down the sequence flow.

The user task is called *Use Solution*. The **usage of the solution** is a subprocess because it might involve a sequence of activities performed by the user. Since this theoretical subprocess depends on individual variables (such as the type of solution in use), it is not modeled within this instance. The user task is carried out with assistance of the user interface and is completed when the use process ends. This may involve rejecting a solution offering, e.g. if a solution is pushed through the provider. An automated message informs the provider that the solution is being used (or has been rejected). This message flow initiates a new instance of the user phase within the touch point pool at the catching message start event (*Solution Usage Received*). The activity also generates real-time usage data. The outgoing data association marks the flow of these *User Data*. Once the user task (*Use Solution*) is completed (rejecting a solution also completes a task), this process instance finishes at the end event (*Solution is Used*).

Furthermore, the catching and conditional non-interrupting boundary event (*Solution Usage*) is attached to the *Use Solution* task so **usage data can be collected**. The event is triggered if a condition becomes true; a token is then cloned and follows the sequence flow from the boundary event. The condition is set to *Solution Usage* (e.g. using a digital ticket to ride a public bus, but also rejecting a solution). The *Use Solution* task must be active for the conditional event to be triggered. If the boundary event is triggered, the parent activity continues as normal. Since the conditional event can be triggered several times during solution use, a token can be repeatedly cloned and sent down the second sequence flow.[730] For instance, a digital ticket solution for mixed transportation is valid for multiple trips within 24 hours. Every time the digital ticket is used during these 24 hours, the boundary event is triggered, and a cloned token follows the outgoing sequence flow. Non-interrupting boundary events that are linked to the *Use Solution* activity are monitored so that data sets can be produced while the solution is being used. These customer usage data are generated in real time during the use process (*Use Solution*). Every activity within the use process (e.g. accessing the car shar-

[729] Refer to White and Miers 2008, 87–88.
[730] Refer to Object Management Group 2011, 440–441.

ing vehicle, rejecting a solution offering) contributes to customer usage data. Information on location, time, and context of usage (e.g. car sharing route and stops, duration, vehicle type, music playlist, indoor/outdoor temperature) also contribute to customer usage data.[731]

The service task (*Transfer User Data*) is not carried out by the user since it is an automated activity where **user data are transferred** by default. Eventually, data transfer equals data storage in the database and allows further data processing. Although the activity is automated, the user might want the opportunity to give consent before future transactions are permitted. These activities are represented by tasks marked with a gearwheel symbol in the upper left corner. This indicates the use of a service, e.g. a web service or an automated application.[732] In the BMC process, the used application is the user interface and the stored data. The service task (*Transfer User Data*) has three incoming data association flows which carry a *User Data object*. For instance, the user signals a recurring issue with a mobility smartcard: the card often fails to open shared vehicles. The user enters this issue in the user interface (*Signal User Data*) and this feedback is transferred to and stored in a database (*Transfer User Data*). In another example, the touch point collects *User Data* from solution usage to learn more about the user and their needs and preferences. For instance, contextual profile data is collected regularly, such as smartphone usage statistics or sensor data in the customer's environment. These data sets are identified *(Collect User Data*) and transferred to a database (*Transfer User Data*), with the user's permission. Real-time usage data, such as geo-tracking data, can also be collected while using a mobility service. Here, the *Transfer User Data* task might transfer real-time data whose value decreases over time. To extract real-time insights from geo-tracking data, these data must be streamed. Data streaming is high-speed data transfer where input data arrive constantly (during usage of the solution) and data processing starts before the input data are transferred completely.[733] Once the task is completed, the user pool's process instance finishes at the throwing signal end event *B* (indicated by the black triangle). When the token arrives, the end event immediately throws a broadcast signal, which indicates successful trans-

[731] Refer to Weiber and Hörstrup 2009, 294–295; Weiber et al. 2011, 118.

[732] Refer to White and Miers 2008; Object Management Group 2011.

[733] The differences between different big data storing, managing, processing, and querying processes, such as streaming data and batch processing are further discussed by Shahrivari 2014 or Yaqoob et al. 2016.

fer of input *B* (*User Data*). The next sequence of activities in the touch point pool is described in the paragraph about collecting user data.

The remaining task, which is intentionally pursued by the user, is the **signaling of user data**. The user phase starts with the user's demand to signal specific *User Data* to the touch point. This is marked by an outgoing data association carrying a *User Data object*. These profile data can contain users' characteristics (e.g. sociodemographic data, habits, opinions, desires/needs, preferences, experiences, hobbies) as well as context information (e.g. used devices/goods/infrastructure).[734] This user activity can be compared with customer service interaction (e.g. call center) since the user can directly communicate with the provider. The user enters the desired information in the user interface and a message is sent to the touch point (dashed line with open arrowhead). This initiates the catching message start event (*Data Signaling Received*) in the touch point pool. The process token within the user pool moves forward to the *Transfer User Data* service task (see paragraph above).

The touch point (e.g. mobile app) acts as an intermediary agent deployed by the provider. There are two main **touch point activities** within the AmI- and IoT-enabled environment: collecting *User Data* and pushing solutions. The user phase can be initiated through the *Data Collecting* start event to **collect user data**. Next, the *Collect User Data* service task identifies relevant data sets and sends requests for data collection to the user through a message flow (dashed line with open arrowhead). As the token continues down the sequence flow, the process is interrupted by the catching intermediate signal event *B* (indicated by the white triangle), which is where the touch point is waiting for the requested *User Data*, i.e. at input *B*. This intermediate event is also the flow object that follows the *Data Signaling Received* and *Solution Usage Received* catching message start events. The triangle embedded in the circular intermediate event marks a signal trigger. The event is triggered the moment the requested user data are successfully transferred to a database. The data are transferred within the user pool and signals are understood as broadcasts from other processes.[735] The throwing signal end event *B* (indicated by the black triangle) broadcasts the signal, which is then caught by the catching intermediate signal event *B*. For instance, the touch point identifies and requests data sets that indicate user characteristics and context such as

[734] See Figure 34 for user data.
[735] Refer to White and Miers 2008, 87–88.

sociodemographic data, residence, worksite or used devices. A message flow originating from the *Collect User Data* service task transfers the request to the user. Another instance of the user phase starts within the user pool at the *Data Collecting Received* catching message start event. The token travels along the outgoing sequence flow until it arrives at the *Transfer User Data* service task. The next sequence of activities within the user pool is described above.

Once user data transfer is broadcast to the catching intermediate signal event *B*, the token travels along the sequence flow and arrives at the business rule task (*Data Analytics: Push Solution?*), which evaluates if the **push of a solution** is needed. The business rule involves data evaluation by an external decision engine (e.g. a self-learning algorithm), which sends back the results and updates the evaluation conditions.[736] Referring to the behavioral customer model and the corresponding pull-push mechanism,[737] the provider can push a solution into the use process. The business rule task processes incoming *User Data* in real time and enables the provider (via the intermediary touch point) to decide whether to push a solution or not.[738] These data streams are managed before they are analyzed. Management includes the extraction, cleaning, and annotation of data as well as integration, aggregation, and representation of data sets. Then, the analytics process starts, which includes modeling and analysis of data.[739]

For instance, a user checks-in with a mobility smartcard, which is a transportation ticket and access key for shared vehicles. The business rule task's engine works with a self-learning algorithm. It registers the checked-in user and collects real-time usage data until check out. The provider is a bus company, and the bus is an object in the IoT environment since it is connected to the internet. Through monitors or smart window displays[740], the bus acts as the user interface in this example. The engine tracks the bus route, and the self-learning algorithm extracts the checked-in user's sex, age, address, and previous mobility patterns. Evaluation of this information deduces that a transporta-

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[736] Refer to White and Bock 2012, 19.

[737] See chapter 5.3.3.1 for the point of use (PoU) component.

[738] Weiber and Hörstrup developed and empirically tested the use process diagram. The framework enables providers to identify specific points in a customer's use process where provider services can be successfully integrated (pushed). Refer to Weiber and Hörstrup 2009, 298–308.

[739] Data analytics techniques include predictive analytics, data mining, case-based reasoning, exploratory data analysis, business intelligence, machine learning techniques. Refer to Tan et al. 2017, 4998.

[740] Transparent smart window displays represent a solution for dynamic information and interaction management in public transport. The Institute of Ubiquitous Mobility Systems (IUMS) at Karlsruhe University of Applied Sciences are publicly sponsored to carry out research on smart windows in public transport. Refer to Bundesministerium für Verkehr und digitale Infrastruktur 2019.

tion solution for the last mile (e.g. a taxi or on-demand shuttle bus) will be accepted by the user with a probability of up to 90%, therefore these services should be pushed into the use process.

In this case, the *exclusive gateway* carries the token down the outgoing path and is evaluated as *yes*. The token arrives at the *Push Solution* service task, and the automated task assembles a ready-to-use solution based on the evaluation, which will be offered to the user (e.g. a taxi to pick the user up at their bus stop). A more subtle solution push might to adapt the suggested driving route to avoid congestion. These pushed solutions can be hidden from the user.

The *Push Solution* service task sends a message to the user pool, which starts a new instance of the user phase. The task is completed once an appropriate solution is chosen based on the results of the business rule task's decision engine, and a message is sent to the user pool. Regardless of whether a solution is pushed in real-time or with a short delay, only solution modules that are already provided in the user interface can be offered. If the business rule task's engine does not identify a need for action, then the *exclusive gateway* carries the token down the other outgoing sequence flow, the condition is evaluated as *no* and the *Solution not Pushed* end event indicates the end of this instance.

The modeled user phase workflow includes:

(1) the **pull, push, and usage of a solution** as well as
(2) the **signaling, collecting, and transfer of user data**.

The provider phase is modeled in the following chapter.

5.4.3.2 Modeling the provider phase

The provider phase is the core of dynamic, user-centric business model design and change. Its participants are the touch point and the provider. The user represents the external factor and massively impacts the business model. Within the user phase, the touch point establishes a direct link between user and provider as it monitors *User Data* within the provider phase. During the provider phase, the provider transfers *Solution Data*[741] into the touch point. These data describe the business model conceptualization, which contains business model components (value proposition, value creation and dis-

[741] Refer to Figure 36 for solution data.

tribution) and the underlying elements (e.g. market segmentation, user benefits).[742] Within the touch point, *User Data* and *Solution Data* are analyzed by a data analytics process geared towards business model change. The outcome is *Value Development Data*,[743] which reveal disparities between customer needs/preferences and the offered solution. The provider uses *Value Development Data* to design the business model.

Figure 50 illustrates the provider-sided BPMN 2.0-modeled section of the BMC process model: the provider phase. Within the provider phase, both **business model design and change activities** take place. *Ideation, prototyping*, and *integration* occur during business model design. Depending on the maturity of the business model and type of change, either an initial concept that roughly depicts the business model components (ideation), a prototype business model (prototyping) or a refined business model whose components are fully aligned (integration) is the result of business model design activities. Observation, analysis, and conceptualization are also activity groups in the provider phase, and form the business model change procedure. Observation takes place when user data are transferred. These user data are saved to a database and examined during the *analysis* step by data analytics. Analysis defines what type of business model change is needed. *Conceptualization* recommends a design for the business model. For example, it defines the business model components and underlying elements that are affected by business model change.[744]

[742] See also chapter 3.1.2 for a dynamic and user-centric business model conceptualization.

[743] Refer to Figure 37 for value development data.

[744] For this paragraph, see chapter 3.2.4.3 for business model design and 3.2.4.2 for business model change activities.

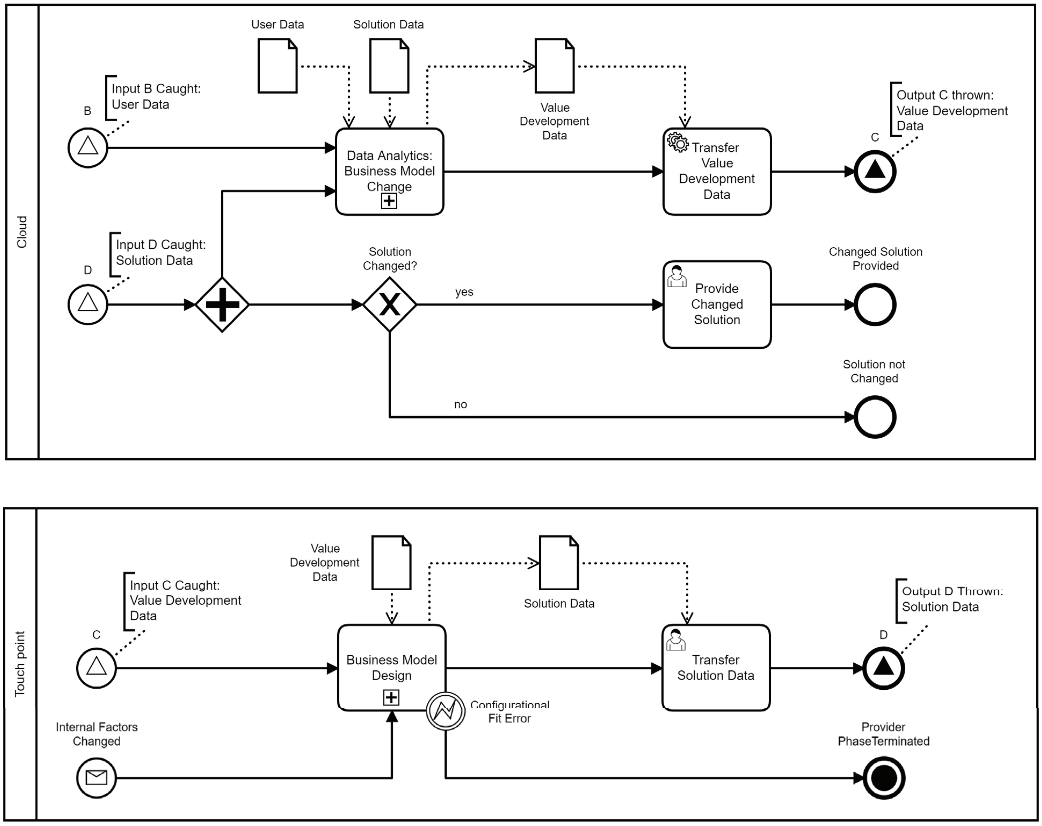

Figure 50: The BPMN-modeled provider phase.

The **touch point** orchestrates two main **activities** in the provider phase: data analytics for business model change and the provision of a changed solution in the user interface.

The catching signal start event *B* and the catching signal start event *D* initiate a new instance of the provider phase. The event is triggered when a signal broadcasts the input of either *User Data* or *Solution Data*. In BPMN, signals are understood as broadcasts from processes that can trigger other processes.[745] The signal for transferred *User Data* is thrown from the touch point pool during the user phase,[746] and the signal for transferred *Solution Data* is thrown from the provider pool within the provider phase. The signal *B* links the user phase and provider phase. Both events generate a token that travels down two sequence flows, and both arrive at the *Data Analytics: Business Model Change* subprocess. This subprocess presents a sequence of activities enabling

[745] Refer to White and Miers 2008, 87–88.

[746] See chapter 5.4.3.1 for the user phase.

big data analytics and business model change conceptualizations. Two associations connect *User Data* and *Solution Data* objects to the subprocess. Depending on the initiating start event, user data or solution data are used throughout the *Data Analytics: Business Model Change* subprocess. The subprocess can access these recently collected user data[747] and solution data[748] as well as processed, analyzed, and stored data sets. Thus, the engine can compare data sets for changes based on a status quo. Figure 51 shows the expanded data analytics subprocess. The *Start Data Analytics* start event initiates the subprocess and sends a token to the *Conduct Data Analytics* business rule task which is operated by a self-learning algorithm. According to the process of extracting insights from big data, the business rule engine manages the stream of big data first. This includes data extraction, cleaning, and annotation as well as integration, aggregation, and representation of data sets. The analytics process then models and analyzes the data.[749] Here, user profiles for each user are defined or revised. These profiles contain user profile and usage data and are also used in market segmentation, which takes place in the provider phase.

Usage data on offered solution modules are categorized by usage frequency and user segment. This analysis might result in a usage pattern, where premium solution modules, such as a mobility assistance, are solely used by a small group of users within a bigger user segment. Mobility assistance works like an insurance service. In case of a train cancellation, for example, a free taxi, rental car, or car sharing service is provided anywhere and at any time. The business rule engine detects a moderate data disparity – i.e. a moderate data need-fit – between solution data (premium solution module, small user group) and user data (low usage frequency). Although these individual, complex evaluation conditions cannot be determined within this dissertation, this example suggests a moderate data disparity. On the one hand, the usage of the premium solution module is low compared with other modules; but on the other hand, the premium solution module is widely used by a specific, small customer group. The engine's self-learning algorithm might examine other conditions to produce a result. These may include value creation and distribution of the premium module, e.g. gains in the value conversion process that can be assigned to the premium solution for profit contribution.

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[747] See Figure 34 for user data.

[748] See Figure 36 for solution data.

[749] Data analytics techniques include predictive analytics, data mining, case-based reasoning, exploratory data analysis, business intelligence, machine learning techniques. Refer to Tan et al. 2017, 4998.

Once the engine has processed and analyzed user data and/or solution data it sends back a result and the business rule task is completed.

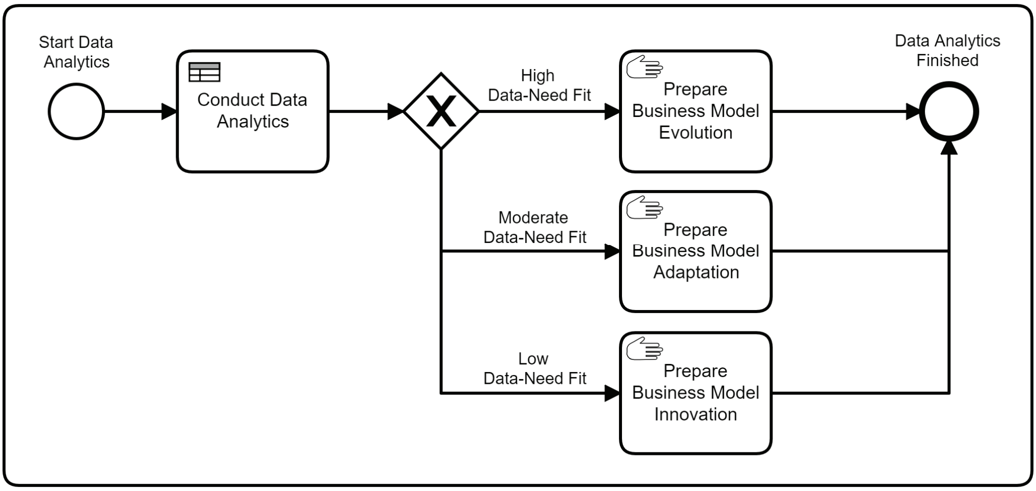

Figure 51: BPMN-modeled expanded business model change data analytics subprocess.

The token arrives at an exclusive gateway, which directs the flow to one of the three outgoing sequence flows according to the business rule task's result. One of the manual tasks *Prepare Business Model Evolution*, *Prepare Business Model Adaptation*, *or Prepare Business Model Innovation* will start immediately. Manual tasks (marked by a hand symbol in the upper left corner) are not automated and are executed by humans.[750] These tasks review the results of the business rule engine and deduce recommendations for the subsequent business model design activities. These recommendations are *Value Development Data*[751] and contain user profiles, the type of change, the planned outcome of change, the scope of change (business model components that are affected), the degree of radicalness, the frequency of change, and the degree of novelty.[752] The functional responsibility for this task can be assigned to corporate and/or business development. The top management addresses the overall corporate strategy, the primary business model structure, major business development, and change decisions. Middle and lower management implements functional business models.[753] Whereas corporate development has a rather strategic corporation-wide focus on business plan-

[750] Refer to White and Miers 2008, 68.
[751] Refer to Figure 37 for value development data.
[752] Refer to Table 9 for types of change in context of the BMC.
[753] Refer to Wirtz 2016, 152–153.

ning, business development activities address the development of specific business fields, services, or products. Business developers introduce new technologies, products, or services to existing markets, meet customer needs with corresponding business models, grow existing markets, and create new ones. Internal collaboration with other departments, such as marketing, research and development, or production, is a necessity.[754]

In the previous example, the token would travel down the outgoing sequence flow that evaluates to *Moderate Data-Need Fit* and arrive at the *Prepare Business Model Adaptation* task. The business rule engine's results might reveal a new, profitable user segment that was a part of a previous, larger user segment. Although mobility assistance is a less frequently used solution module, its users are solvent and loyal customers seeking safety and comfort. Business developers might adapt the business model to change the value proposition. For instance, they may suggest splitting up the larger segment and establishing a new user segment of safety and comfort-seeking users with corresponding user benefits and solution specifications.

In another case, business developers might discover that mobility assistance is an inefficient premium solution module and should be removed from all solution offerings. Their recommendations to adapt the business model would affect the business model's value proposition as well as its value creation and distribution. The benefits proposed to the customer and the solution specifications must be changed because the premium module has been removed. Additionally, the partner network must be restructured since the contract with the insurance company that currently provides mobility assistance will be cancelled.

The manual tasks *Prepare Business Model Evolution*, *Prepare Business Model Adaptation*, or *Prepare Business Model Innovation* are completed as soon as recommendations for business model change and subsequent design are determined. *Data Analytics Finished* ends the data analytics subprocess. The token then exits the *Data Analytics: Business Model Change* and travels down the sequence flow to the *Transfer Value Development Data* user task (Figure 50). This is where **value development data are transferred** by a human, e.g. a team member that worked a task in the previous subprocess. Eventually, data transfer equals manual data input and storage in the database. *Transfer Value Development Data* has one incoming data association flow which

754 Refer to Kohne 2019, 5.

carries a *Value Development Data* object. This is the output of the *Data Analytics: Business Model Change* subprocess. Once the task is completed, the instance finishes at the throwing signal end event *C*. When the token arrives, the end event immediately throws a broadcast signal, which indicates the successful transfer of output C (i.e. value development data).

The sequence flow attached to the catching signal start event *D* splits into two sequence flows with two cloned tokens. One token arrives at the *Data Analytics: Business Model Change* subprocess and the other token arrives at the *Solution Changed?* gateway. This can initiate the **provision of a changed solution** in the user interface. This process path is the second link between the user phase and provider phase because it guarantees provision of the latest market-ready solution to the user. Altered business model designs that affect the solution offering are immediately implemented in the interface.[755] A direct connection between the provider phase and user phase is established.

For example, the business model's value proposition component may be adapted. A new solution (such as an electric scooter service in a mobility solution) is added and must be provided in the user interface. In another example, the business model's value creation and distribution component is altered. Transactions and corresponding revenue streams within the partner network are redefined to offer a new solution pricing model, e.g. a mobility flatrate for heavy users. Some changes to business model design are not noticed by the user. For example, changing a supplier in the value network to one that provides the same service; in this case, the user would not notice any difference in the market-ready solution offering.

In the first two cases, the process token follows the outgoing sequence flow whose condition evaluates to *yes*. The token then arrives at *Provide Changed Solution*, and the changed solution is made accessible to the user via the user interface. The functional responsibility for this task might be assigned to the IT department or an external network partner since it involves designers and developers. This process instance ends at *Changed Solution Offering Provided*. Alternatively, the solution offering does not need changing. In this case, the token moves down the outgoing path whose condition evaluates to *no*. This process instance ends at *Solution Offering not Changed*.

There is one **provider activity** in the provider phase: **business model design**. The modeled instance is the only BMC model that directly addresses the impact of internal

[755] See Figure 36 for solution data.

factors on the business model design. The *Internal Factors Changed* start event is triggered by a message. The management or department (e.g. marketing, operations) inform other departments about changing internal factors. These changes frequently aim to improve the efficiency of activities, relations, and operations,[756] and are not connected to the changing business environment (external factors). These internal changes are outcomes of middle to top management decisions and dynamics within or between business model components.[757] These dynamics occur once the business model is implemented. For instance, the management decides to part from one of its value network partners. This decision directly affects the business model's value creation and distribution – and eventually the value proposition too. This might happen when a key partner is not replaced, and specific solution modules can no longer be offered to the user. In this example, the business model's value proposition, value creation, and value distribution would be affected by the internal change.

The catching signal start event *C* can also initiate a new instance of the provider phase within the provider pool. The event is triggered when a signal broadcasts the input of *Value Development Data*. If the *Business Model Design* subprocess is started by the catching signal start event *C* it receives the data object *Value Development Data* from its parent process (Figure 50). Within this process instance, the data object acts as input data for the whole subprocess and its activities.

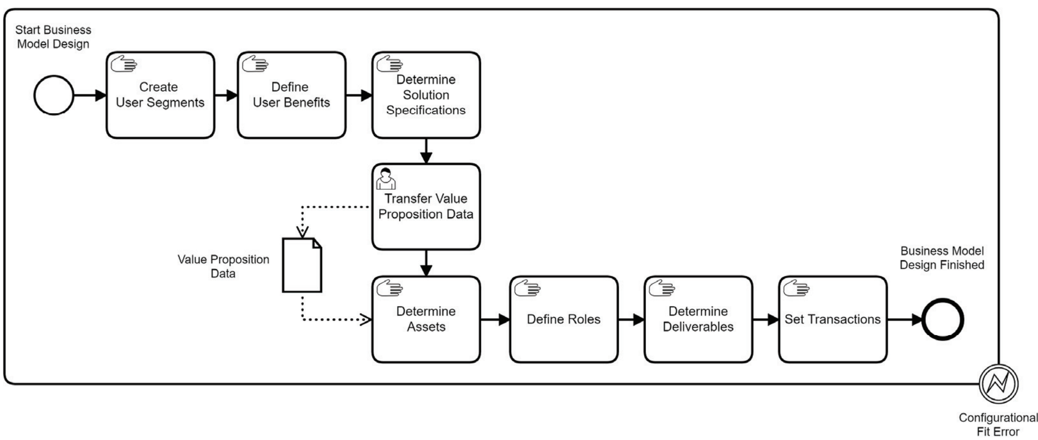

Figure 52: BPMN-modeled expanded business model design subprocess.

756 Refer to Saebi 2015, 150.

757 Refer to Demil and Lecocq 2010, 236–237.

After one of the two start events is triggered, the token arrives at the *Design Business Model* subprocess. Figure 52 presents the expanded, BPMN 2.0-modeled subprocess of business model design. The expanded subprocess features two main activity groups: value proposition and value creation and distribution. These groups are taken from BMC sub-model components with the same name and correspond to the business model configuration.[758] All manual tasks within the subprocess are performed by humans. Besides business development, other specialty departments (e.g. marketing, operations, finance) might be involved in the subprocess. Since organizational structures and procedures differ between corporations, task responsibilities are not determined within the subprocess. The *Start Business Model Design* start event initiates the subprocess and the token travels down the sequence flow to the first manual task (*Create User Segments*), which also starts the design of the business model's value proposition component. The task is completed when homogeneous segments for diverse groups of users are developed. Next, *Define User Benefits* specifies a benefit or a bundle of benefits that is offered to the user segments.[759] The next manual task (*Determine Solution Specifications*) is assembling the solution. Solutions contain modules with integrated products and/or services. Every solution is highly customized in favor of its linked user segment and the corresponding benefits.[760] At this point, the design of the business model's value proposition component is completed. The *Transfer Value Proposition Data* user task is executed by a human with the help of internal software. Value proposition data include user segments, user benefits, and solution specifications and act – along with *Value Development Data* – as an input for following activities. Data association carries the *Solution Data* object from the first activity group to the second, and design of the business model's value creation and distribution component begins. The first manual task (*Determine Assets*) is choosing network partners that provide adequate assets for the solution specifications. Tangible or financial assets include goods, services, and revenue; intangible or non-financial assets include knowledge, information, customer loyalty, and internal structures.[761] The task is completed as soon as a network of partners with suitable assets is established. The *Define Roles* manual task assigns roles (such as the focal firm, suppliers, complementors, investors, distributors, strategic busi-

[758] Chapters 3.1.2 and 5.3.4.4 thoroughly examine and describe the determinants, mechanisms and interconnections of the two business model components.

[759] Refer to zu Knyphausen-Aufseß and Meinhardt 2002; Morris et al. 2005; Bieger and Reinhold 2011.

[760] See chapter 5.3.4.3, Figure 39 in particular for activities within the value proposition component.

[761] Refer to Vanhaverbeke and Cloodt 2006, 266.

ness partners, and users) to network partners. Roles in a value network are not the same as roles in a single firm; network roles depend on different activities, i.e. the supply and processing of tangible and intangible network assets.[762] Once the roles are defined, the token arrives at the next activity. *Determine Deliverables* is a manual task where network partners utilize their asset base and individual network role to create deliverable value that can be exchanged between network partners (e.g. knowledge that is condensed into a report transforms into a physical deliverable).[763] *Set Transactions* marks the final activity to develop the business model's value creation and distribution component. Transactions describe exchange processes between network players. During these exchanges, the type and number of exchanged deliverables are registered. Therefore, transactions specify the distribution of value within the network.[764] Once the assets, roles, deliverables, and transactions are determined or redefined, value conversion from value creation to value distribution can be described within the business model. The subprocess is completed when the token arrives at the *Business Model Design Finished* end event.

Configurational Fit Error is a catching error interrupting boundary event that is attached to the subprocess, and can cause a sequence of activities that **terminate the provider phase**. The event is triggered if an error occurs, and interrupts the subprocess. The token follows the boundary event's outgoing sequence flow. The error is set to *Configurational Fit Error*, which describes a rare event in the business model design subprocess. The configurational fit of a business model aligns business model components or underlying elements in such a way as to create harmony and synergies and to secure the model's effectiveness.[765] The components of a business model are interconnected because their value depends on the value of other components. They can also reinforce each other in that the value of one component increases the value of another. The stronger the reinforcement between business model components, the higher the degree of configurational fit.[766] The *Business Model Design* subprocess aims to increase the configurational fit in accordance with changing external (i.e. *Value Develop-*

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[762] Refer to Allee 2008, 12–14, 2009, 429.
[763] Refer to Allee 2009, 430.
[764] Refer to Allee 2008, 14.
[765] Refer to Magretta 2002, 6; Nenonen and Storbacka 2010, 51–52; Kindström and Kowalkowski 2015, 10.
[766] Refer to Nenonen and Storbacka 2010, 51–52; Storbacka et al. 2012, 64–65.

ment Data) and internal factors. *Configurational Fit Error* is triggered only if there is no possibility of adapting the business model to a configurational fit.

In an example, *Value Development Data* suggest innovation within the existing business model, e.g. a radical adaptation of both business model components to disrupt market conditions and create novelty. If adapting and realigning the business model components cannot achieve a configurational fit, then the initial business model might be declining or degenerating. In this case, Wirtz suggests either relaunching the business model or ending business model change and following a strategy of disinvestment.[767] Since the first strategy of business model innovation was already suggested by data analytics and could not be implemented, the second strategy of disinvestment is applied.

Once the *Configurational Fit Error* is triggered, the parent subprocess is interrupted and the token moves on to the terminate end event (BMC *Process Terminated*) (Figure 50). This end event terminates the phase by interrupting all active process instances within the provider phase.

Once the *Design Business Model* subprocess ends, the token travels down the sequence flow and arrives at the *Transfer Solution Data* user task, which indicates successful **transfer of solution data** to the touch point. Data association carries a *Solution Data* object and connects the subprocess with the user task. The task is executed by a human with the help of internal software. For example, the solution data are entered into a database by someone who was involved in designing the business model. Data storage equals successful data transfer since every application within the touch point (e.g. mobile app) can access the latest *Solution Data*. At this point, the token moves down the sequence flow and arrives at the throwing signal end event *D*. As soon as the token arrives, the end event immediately throws a broadcast signal, which indicates the successful transfer of output *D* (i.e. the *Solution Data*).

[767] Refer to Wirtz 2018, 261.

6 Case study research: BMC application exemplified by mobility solution provider

The following case study is a practical example of the dynamic, user-centric BMC model. It identifies valuable similarities and differences in the process design, and shows how a dynamic, user-centric business model design can give a competitive edge. This case study also investigates why external factors other than the user are essential for dynamic business model design and change.

6.1 Case studies as a research strategy

6.1.1 Case study methodology in research

Case studies are useful in research because they can encompass the complexity of social phenomena and real-live events, such as processes in organizations.[768] Compared with quantitative surveys that examine research objects at a specific point in time, case studies can reveal dynamics, evolution, and causal chains in real-life environments.[769] Although some social scientists argue that case studies are purely exploratory, Yin suggested case studies can also be exploratory, explanatory, and descriptive research techniques.[770] Yin also pointed out that case studies should start with a theory, regardless of whether the case study will develop or test a theory.[771] Accordingly, the author advocated for deductive reasoning and described this approach as 'analytic generalization' "[…] in which a previously developed theory is used as a template with which to compare the empirical results of the case study."[772] Case study data can be collected through interviews, surveys (e.g. face-to-face, by phone, paper-and-pencil), observations, documents, and archival records.[773]

Single-case designs examine a single-unit of analysis. This can be a person, a group of individuals, an organization, or a society or culture.[774]

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[768] Refer to Yin 2003, 1–2.
[769] Refer to Borchardt and Göthlich 2009, 36
[770] Refer to Yin 2003, 3–5.
[771] Refer to Yin 2003, 28–29.
[772] Yin 2003, 32–33.
[773] Refer to Yin 2003, 97–105; Borchardt and Göthlich 2009, 37–43.
[774] Refer to Schnell et al. 1989, 240; Kromrey 2006, 534.

6.1.2 Case study research design

The following research design outlines a logical plan for data collection, analysis, and interpretation. Empirical data will be linked to the case study's research questions.[775] Table 11 lists research design components and the corresponding characteristics of this case study.

Research design components	Characteristics of the conducted case study
Unit of analysis	• B2C: Door2Door GmbH / firm x[776] 'ridepooling in city x'[777] business model • B2B: Door2Door GmbH 'software as a service' (SaaS) business model
Type of research strategy	Longitudinal single-case study
Type of research outcome	Descriptive, explanatory
Data sources	Expert interviews; secondary data analysis of consumer survey
Research questions	• How is dynamic, user-centric business model design and change implemented into the unit of analysis? • Why is dynamic, user-centric business model design and change crucial to developing and sustaining a competitive advantage?
Case study proposition	Dynamic, user-centric business model design and change is crucial to developing and sustaining a competitive advantage.
Logic of linking the data to the proposition	• To what degree is the unit of analysis designed and changed according to the BMC? • Which part of the design and change process of the unit of analysis is crucial for developing and sustaining a competitive advantage?
Criteria for interpreting the findings	• Identifying matches and mismatches between design and change process of unit of analysis and BMC (dynamic and user-centric criteria) • Operationalization and evaluation of competitive advantage

Table 11: Case study research design.
Adapted from Yin 2003, 21-28;39-42;97-100.

The *unit of analysis* is the Door2Door GmbH[778] business model in 2016 and 2019. door2door was founded in 2012. Their headquarters are in Berlin and a second site for geoinformatics is located in Porto Alegre, Brazil. About 100 employees work for door2door and will generate an estimated revenue of 5 million euros in 2020. door2door is a software company but is also a player in the mobility sector because of the services they provide. Their customers are mainly transportation companies, but they also have

[775] Refer to Yin 2003, 20–21.
[776] The company name was anonymized to 'firm x' throughout the dissertation.
[777] The business model name was anonymized to 'ridepooling in city x' throughout the dissertation.
[778] The corporate name is Door2Door GmbH but complying with its use towards customers and on their website, the name 'door2door' is used throughout this dissertation.

corporate customers. In 2016, door2door started to offer ‘software as a service’ (SaaS) including a white-label ridepooling[779] platform. The company hosts, operates, and refines the platform for ridepooling services on behalf of their customer (e.g. public transport company). Additionally, door2door offer ‘professional services’ to support their customers with service design, project management, legal issues, and funding acquisition. This dissertation focuses on the 2019 ‘ridepooling in city x’ business model in cooperation with firm x. The ‘ridepooling in city x’ business model is a real-life version of the 2016 business model. The offered solution is a ridepooling service and the user is the focus of attention (B2C).

The chosen *research strategy* is a longitudinal single-case study. The unit of analysis was examined in 2016 and in 2019. The *type of research outcome* is descriptive, i.e. it describes how the unit of analysis has been designed and changed. The outcome was explanatory when specific business model design patterns and change processes were detected that provided a competitive advantage. Within the single-case study, *multiple data sources* were used. Two interviews were conducted at two different points in time (2016[780], 2019[781]) with expert Maxim Nohroudi,[782] co-founder, co-owner, co-chief, executive officer, and associate of door2door. He manages the growth division. The interviews had a duration of 2.5 and 3 hours. A secondary data analysis was also performed on the results of a representative consumer survey.[783] The case study is guided by two *research questions*:

- How is a dynamic, user-centric business model design and change implemented into the unit of analysis?
- Why is a dynamic, user-centric business model design and change crucial to developing and sustaining a competitive advantage?

These *how* and *why* research questions are explanatory and are particularly suited to case study research because “[…] such questions deal with operational links needing to

779 Ridepooling “[…] involves sharing a ride at a reduced fare with someone else taking a similar route […]”. Shaheen and Cohen 2019, 431.

780 See Appendix 2 for the 2016 expert interview questionnaire.

781 See Appendix 3 for the 2019 expert interview questionnaire.

782 Mr. Nohroudi has given his consent to publish his name and the name of his company door2door in the context of this case study. Throughout this dissertation Mr. Nohroudi is referred to as Nohroudi interview 2016, or Nohroudi interview 2019.

783 The representative consumer survey (n=1005) by von Berg and Graff was carried out in cooperation with the Innovation Center for Mobility and Societal Change (InnoZ) in Berlin in 2014/2015 and finalized in 2016. Refer to von Berg and Graff 2016.

be traced over time, rather than mere frequencies or incidence."[784] The *research proposition* says that dynamic, user-centric business model design and change are crucial to developing and sustaining a competitive advantage. To *link the data to the research proposition*, two questions must be answered:

- To what degree is the unit of analysis designed and changed according to the BMC?
- Which part of the design and change process of the unit of analysis is crucial for developing and sustaining a competitive advantage?

To answer these questions, the *criteria for interpreting the findings* must be determined:

- Identifying matches and mismatches between the design and change process of the unit of analysis and the BMC (dynamic and user-centric criteria)
- Operationalization and evaluation of competitive advantage.

Matches and mismatches can be obtained by transferring the design and change process of the unit of analysis to the BMC process model. Here, dynamic and user-centric criteria are used for comparison,[785] and matches and mismatches can be observed. The competitive advantage is operationalized by a causal chain. To develop and sustain a competitive advantage, an internal and external fit of the business model (i.e. dynamic consistency) must be maintained.[786] Therefore, managers must acquire dynamic capabilities; the continuous process of dynamic, user-centric business model design and change is one such dynamic capability.[787] A competitive advantage is developed or sustained when these business model design and change activities are successful, i.e. when they maintain dynamic consistency, and/or the business model (especially all the assets) is not terminated, and/or the business is not liquidated.

6.1.3 Quality of case study research design

The quality of research design can be measured by specific criteria and tests. Table 12 lists these quality criteria, asks a defining question for each criterion, and describes the corresponding approaches and tactics applied in this case study.

[784] Yin 2003, 6.

[785] See chapters 2.1 and 2.3 for dynamic and user-centric criteria.

[786] Refer to Magretta 2002, 6; Demil and Lecocq 2010, 241–242; Nenonen and Storbacka 2010, 51–52; Frankenberger et al. 2013a, 265–267; Kindström and Kowalkowski 2015, 10; Gassmann et al. 2017b, 66–69.

[787] Refer to Demil and Lecocq 2010, 241–244; Amit and Zott 2015, 13–15; Juntunen 2017, 192–194; Teece 2018, 40–43.

Quality criteria	Defining questions	Case study approaches
Construct validity	Is the operational set of measures sufficient?	+ Two sources of evidence used + BMC configuration as a theoretically grounded, comparative measure - Triangulation could not be applied (separate sub-studies)
Internal validity	Is a causal chain established?	+ Causal chain for second, explanatory research question is established + Rival explanations for developing and sustaining a competitive advantage will be addressed
External validity	Are the study's findings generalizable?	+ Analytic generalization approach is applied to single-case study - No replication logic (multiple-case studies) applied
Reliability	Can the case be studied again with the same results?	+ BMC configuration as a theoretically grounded, comparative measure that is applicable to all industries and business models (meta-model) or to digitalized business models (sub-model, modeled instance) + Causal chain for second, explanatory research question is established

Table 12: Research design quality criteria and corresponding approaches of the case study. Adapted from Yin 2003, 33–39.

Construct validity is undermined when applied measures are not operational and evidence selection is subjective.[788] To counteract this, two data sources have been chosen, and the theoretical BMC can be used as a comparative, transferable measure in the research process. However, data triangulation (i.e. using data from multiple sources that confirm the same phenomenon) cannot be applied because the data sources are from different sub-studies. Here, the construct validity is not further reinforced. *Internal validity* can only be applied to explanatory research questions. This is why a causal chain has been used to answer the second research question in this single-case study.[789] Rival explanations (e.g. other external factors in the business model environment) for a competitive advantage will also be addressed.[790] *External validity* refers to the study's findings being generalizable. To reinforce external validity, the analytic generalization approach has been applied to this study.[791] Since a single-case study research design was chosen, the replication logic of multiple-case study designs cannot further corroborate external validity.[792] *Reliability* refers to the same case being studied

[788] Refer to Yin 2003, 35.
[789] See chapters 3.2.3 and 6.1.2 for the causal chain regarding competitive advantages.
[790] Refer to Yin 2003, 36.
[791] See chapter 6.1.1 for the analytic generalization approach.
[792] Refer to Yin 2003, 37.

again in the same way and producing the same result.[793] Because the BMC configuration is a theoretically grounded, comparative measure that is applicable to all industries, business models (meta-model), and digitalized business models (sub-model, modeled instance), the answer to the first descriptive research question should be the same. In the second research question, the derived causal chain that operationalizes a competitive advantage allows little room for interpretation.

6.2 Findings of secondary research in the mobility sector

6.2.1 Mobility behaviors

In transport planning, *multimodality* is used to describe a certain mobility behavior. Multimodal users are not dependent on one mode of transportation; they use two or more modes over the course of one week. This is also called trip-based mobility behavior.[794] *Intermodality*, on the other hand, arises from the container traffic of the 1960s – a time when the size of modern cargo containers was standardized and containers were easily moved between modes.[795] Intermodal travelers combine different transport modes along a journey.[796] Table 13 presents the mobility behaviors.

	Definition	**Time reference**	**Use of…**	**Mobility behavior**
Monomodal travel	Exclusive use of one means of transportation within a given period of time	Period of time, e.g. one week	…single means	No alternating use of trans-portations
Multimodal travel	Use of different means of transport within a given period of time	Period of time, e.g. one week	…multiple means of transport	Alternating use of trans-portations
Intermodal travel	Combination of different means of transport along a journey	Journey	…multiple means of transport	Interlinking use of trans-portations

Table 13: Mobility behavior.
Adapted from Nobis 2015, 21.

In 2017, 36% of Germans used two or more means of transportation in the course of one week (42% in metropolitan cities). Multimodal routines are more common among young adults.[797] An increasing share of Germans aged between 18 and 29 are multi-

[793] Refer to Yin 2003, 37–39.
[794] Refer to Nobis 2007, 35; Klinger 2017, 223
[795] Refer to Donovan 2000, 317.
[796] Refer to Nobis 2007, 35.
[797] Refer to Nobis and Kuhnimhof 2018, 57.

modal travelers. Their daily car use decreased between 2002 and 2008, and bicycle and urban public transport use increased.[798] Multimodal mobility users travel shorter distances by car than monomodal car users do. The higher the number of used modes per week, the fewer the number of kilometers traveled by car each day.[799]

6.2.2 Users in the mobility market

The once fragmented mobility market is converging since new competitors from other industries enter the market and established market players extend their offerings to multimodal mobility. A user-centric market segmentation of this new, urban mobility-focused market was derived by von Berg and Graff and contains five user segments (Figure 53).[800]

Using factor analysis, these user segments are distinguished by their individual need patterns and psychographic criteria (such as mobility behavior, technology and innovation affinity, and ecological awareness).

Individualists are mainly multimodal travelers (33%) with a tendency towards public transport and cycling (20%). They have a high affinity to innovation and ecological issues, and every fifth user is a technophile. Individualists like to customize products and services. Their need for individuality is high above average. When they seek appreciation, it is usually for their cognitive abilities. They are not interested in safety and support services, and easily manage in foreign environments. Data security is important to them.[801]

The satisfied prefer to travel by car; 50% are traditional monomodal car users with a below-average awareness of the environment. None of their need intensities stand out as the highest. The satisfied are attracted to mobility solutions that allow adaptability and flexibility. They do not self-display their cognitive abilities or materialistic status symbols.[802]

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[798] Refer to Kuhnimhof et al. 2012, 445–447.
[799] Refer to Nobis and Kuhnimhof 2018, 59.
[800] Refer to von Berg and Graff 2016, 46–47.
[801] Refer to von Berg and Graff 2016, 46; von Berg and Randelhoff 2019.
[802] Refer to von Berg and Graff 2016, 46; von Berg and Randelhoff 2019.

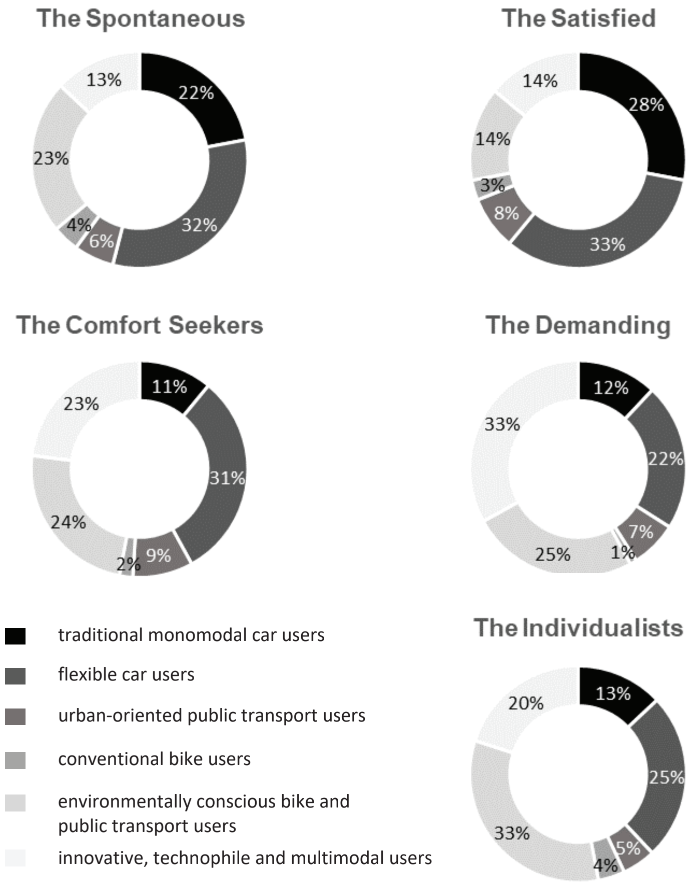

Figure 53: User segments within the mobility market.
Adapted from von Berg and Graff 2016, 46–47; von Berg and Randelhoff 2019.

The demanding are multimodal travelers, and more than a third are technophiles. This user segment is hard to please since their need intensities are highest. They demand support, especially when traveling in a foreign environment, and data privacy is a key issue. Appreciation for cognitive abilities and materialistic status symbols is well received. They also enjoy simplicity, easy handling, and comfort in products and services.[803]

Comfort seekers mainly travel by car, but almost a third are flexible car users and are open to trying other modes of transportation depending on the situation. One quarter

[803] Refer to von Berg and Graff 2016, 46–47; von Berg and Randelhoff 2019.

are multimodal travelers. Comfort seekers have the strongest need for comfort and are attracted to exclusive style and convenience. They are not demanding regarding data privacy and flexibility.[804]

The spontaneous rely on the car; they have the second highest share of traditional monomodal car users and the smallest share of innovative, technophile, and multimodal users. Flexibility and simplicity are the most important factors in the daily lives of the spontaneous. They prefer products that are easy to handle and do not value individuality or extra comfort. The spontaneous are not too concerned about safety.[805]

6.2.3 Multimodal mobility solutions

Multimodal mobility solutions integrate services that enable people to get from A to B with diverse but connected means of transport. Von Berg and Randelhoff introduced two descriptive measures for multimodal mobility solutions:[806]

- Level of diversity (LoD)
- Level of connectedness (LoC).

The LoD refers to the number of distinct mobility services or non-mobility services offered within the multimodal mobility solutions. Mobility services include:[807]

- Short- and long-distance public transport (e.g. bus, train, tram, metro, taxi, ferries)
- Sharing services (e.g. carsharing, bikesharing, electric scooter sharing, car rental)
- Demand responsive services (e.g. ridesharing, ridehailing, ridepooling, taxi).

There are many non-mobility services, e.g. food delivery after a holiday, lounge access, cleaning services. The larger the set of integrated services, the higher the complexity of a multimodal mobility solution. Travelers that combine different means of transport and mobility services on a journey must be willing to plan ahead and forgo comfort compared with travelers who use a private car.[808]

[804] Refer to von Berg and Graff 2016, 46–47; von Berg and Randelhoff 2019.

[805] Refer to von Berg and Graff 2016, 46–47; von Berg and Randelhoff 2019.

[806] Refer to von Berg and Randelhoff 2019.

[807] These diverse mobility services and modes of transport are beyond the scope of this dissertation. Comprehensive overviews of service characteristics can be found in Durand and Harms 2018; Shaheen and Cohen 2019; von Berg and Randelhoff 2019.

[808] Refer to Meyer de Freitas et al. 2019, 201

The *LoC* refers to digital and physical infrastructure that connects and integrates the various mobility services into one solution offering. Digital and physical infrastructure reduces the complexity of multimodal mobility solutions and raises its usability.[809]

Digital infrastructure includes information, routing, planning, booking, access, fares, and payment as well as integration of additional digital services. Mobile apps (e.g. multi-modal aggregators, trip planners, booking systems) enable the user to book, access, and pay for diverse mobility services. The user receives relevant travel information, e.g. timetables, delays, real-time routing, pricing via geo- and real-time data. *Physical infra-structure* refers to access and connection points between modes (spatial access is essential for mobility services). Mobility services must be closely linked at transportation nodes, such as railway stations or mobility hubs. Clear signs help the user to navigate these surroundings. Designated spaces for shared vehicles or parking facilities for individual vehicles (e.g. private cars, bike) facilitate spatial access on intermodal journeys.[810]

6.3 Single-case study: door2door

6.3.1 Procedure of investigation

This chapter answers the following *research questions*:

- How is dynamic, user-centric business model design and change implemented into the unit of analysis? (descriptive)
- Why is dynamic, user-centric business model design and change crucial to developing and sustaining a competitive advantage? (explanatory)

To answer the first question, the degree to which the unit of analysis is designed and changed according to the BMC will be examined. Matches and mismatches between the design and change process of the unit of analysis and the BMC will be identified. This procedure is conducted in four chapters:

- Description of unit of analysis (chapter 6.3.2)
- Application of BMC meta-model to unit of analysis (chapter 6.3.3.1)
- Application of BMC sub-model to unit of analysis (chapter 6.3.3.2)
- Application of the modeled instance of the BMC to unit of analysis (chapter 6.3.3.3)

[809] Refer to Hilgert et al. 2016, 58–59; Gössling 2017; Durand and Harms 2018, 16–21.

[810] Refer to Shaheen et al. 2016, 8–9; Gössling 2017; Durand and Harms 2018, 10–11; Matyas and Kamargianni 2019, 1951–1953; von Berg and Randelhoff 2019.

First, the unit of analysis is described, i.e. the specific business model configurations in 2019. Second, the BMC meta-model, the BMC sub-model, and the modeled instance of the BMC are applied to the 'ridepooling in city x' business model. This procedure reveals matches and mismatches between the theoretical processes and real-life processes. Dynamic, user-centric criteria serve as guidelines for comparison.[811]

The second research question will be answered by investigating which part of the design and change process of the unit of analysis is crucial for developing and sustaining a competitive advantage. Here, examples of door2door business model innovation, adaptation, and evolution will be discussed. The competitive advantage will be operationalized by a causal chain.[812] Specific design and change processes (innovation, adaptation, evolution) that occurred to the unit of analysis between 2016 and 2019 will be described, and the successes of developing and sustaining a competitive advantage will be evaluated. These findings will show why dynamic, user-centric business model design and change are crucial to developing and sustaining a competitive advantage and which activities have the greatest impact. The result will be compared with the study hypothesis that dynamic, user-centric business model design and change is crucial to developing and sustaining a competitive advantage. To strengthen internal validity, rival explanations for developing and sustaining a competitive advantage will also be addressed.

6.3.2 Description of 'ridepooling in city x' business model

The unit of analysis is the door2door/firm x 'ridepooling in city x' business model. The 'ridepooling in city x' service provides on-demand mobility to customers in city x[813]. The pilot phase started in mid-2018. A number of x vehicles are currently used to pick up users at digital stops and take them to their chosen destinations.[814] These rides are shared with other users.[815]

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[811] See chapters 2.1 and 2.3 for dynamic and user-centric criteria.

[812] See chapters 3.2.3 and 6.1.2 for the causal chain regarding competitive advantages.

[813] The name of the city was anonymized to 'city x'.

[814] The number and type of vehicles were anonymized. Status Q4 2019: Additionally, x barrier-free vehicles and large-capacity taxis will be driving in future. Capacity peaks are absorbed by taxi services. The status Q4 2019, i.e. details and size of the fleet, and operating times were anonymized or deleted. Refer to Nohroudi interview 2019.

[815] For this paragraph, refer to Nohroudi interview 2019.

This chapter examines the configuration of the 'ridepooling in city x' B2C business model.[816] The configuration includes the components described in chapter 3.1.2: value proposition, value creation and distribution, and value development.

Value proposition

Figure 54 illustrates the value proposition, which contains user segments, user benefits, and solution specifications. Firm x aims to reach multimodal users that are open to new mobility services (young, technologically-affine adults in particular). But they also want to provide a convenient solution to users that usually rely on their private car.[817] Von Berg and Graff identified a user segment subset that is open to multimodal mobility options. The individualists, demanding, and comfort seekers are more likely to use multimodal mobility solutions.[818] While the individualists and the demanding use multimodal travel, the comfort seekers mostly rely on the car (but are open to other modes of transport).[819] Therefore, proposed user benefits are convenience and comfort. The on-demand ridepooling service provides these benefits. The solution can be differentiated by its LoD and LoC.[820] In this case study, the LoD is low because the offered solution only includes on-demand ridepooling services. However, firm x offers diverse services from public transport fleets (bus, streetcar, metro) to self-operated bikesharing, and co-operation with various carsharing providers. These multimodal services are beyond the scope of this dissertation.

[816] See chapter 3.1.2 for business model configurations.
[817] Refer to Nohroudi interview 2019.
[818] Refer to von Berg and Graff 2016, 47.
[819] See chapter 6.2.2 for multimodal users.
[820] See chapter 6.2.3 for LoD and LoC.

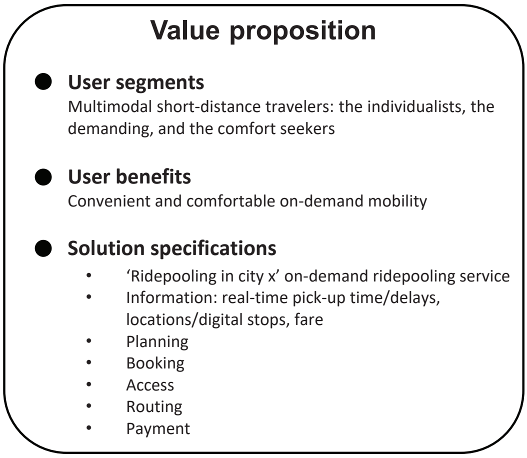

Figure 54: Value proposition of 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The LoC, on the other hand, is very high. The mobile ‘ridepooling in city x’ app offers a fully integrated solution that includes the following digital services: information (e.g. real-time pick-up time/delays, locations/digital stops, fare), planning, booking, access, routing, and cashless payment. The service is also complemented by its physical infrastructure. Signs at bus stops direct users to ‘ridepooling in city x’, and ridepooling shuttles can pick passengers up at bus stops.[821]

Value creation and distribution

Figure 55 presents *value creation and distribution*, which involves the value network partner’s assets, deliverables, roles, and transactions.

[821] For this paragraph, refer to Nohroudi interview 2019.

Value creation & distribution

▼ **Assets**

- Software, algorithms, data analytics, simulation
- Knowledge, feedback
- Negotiating skills
- User data
- External data
- Vehicles and driver pool
- Decisive power, influence
- Financial assets

▼ **Deliverables**

Ridepooling service, SaaS (including ridepooling platform), professional services (e.g. stakeholder and supplier management, license and funding application, project management), vehicles, drivers, license, funding, cooperation, user data, external data, knowledge, feedback, negotiations, applications, registration, customer service, revenue

▼ **Roles**

Focal firm, customer, stakeholder/gatekeeper, supplier, user

▼ **Transactions**

- Focal firm: SaaS, professional services, knowledge, feedback, user data, negotiations, applications
- Customer: Revenue, knowledge, feedback, registration, customer service
- User: User data, revenue
- Supplier: External data
- Supplier: Ridepooling service, vehicles, drivers
- Stakeholder/gatekeeper: License, funding, cooperation

Figure 55: Value creation and distribution of 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The value network contains five partners with the following roles: focal firm (door2door), customer (firm x), stakeholders/gatekeepers (associations, city council, federal state), suppliers (car leasing company, driver agency, taxi business), and users (ridepooling users).[822] The assets, deliverables and transactions are examined in a detailed network setup in chapter 6.3.3.2.

Value development

Figure 56 shows value development, which involves the indicators of value change and the value transition process. The indicators of value change are customer feedback (firm x), user data, and external data. User data include real-time usage data (such as start and destination), vehicle occupancy, waiting times, and context information (e.g. weather, special events). Anonymized profile data such as email feedback or survey

[822] For this paragraph, refer to Nohroudi interview 2019.

results are collected infrequently, too. Further information comes from external data. door2door, for example, purchase anonymous location data from mobile network operators to design the ridepooling solution.[823]

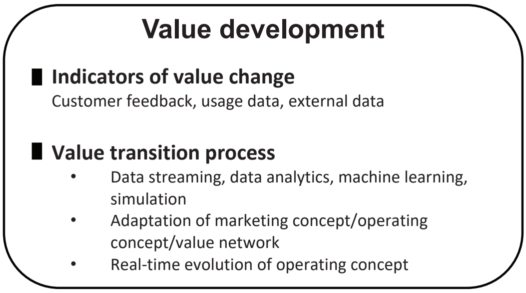

Figure 56: Value development of 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The value transition process is realized by state-of-the-art software for data collecting and processing, such as data streaming and machine learning.[824] The value transition process is further examined in chapter 6.3.3.

6.3.3 Descriptive case study findings

6.3.3.1 Application of BMC meta-model to ‘ridepooling in city x’ business model

As shown in Figure 57, the door2door/firm x ‘ridepooling in city x’ 2019 business model can be adapted to the BMC meta-model.

[823] For this paragraph, refer to Nohroudi interview 2019.
[824] For this paragraph, refer to Nohroudi interview 2019.

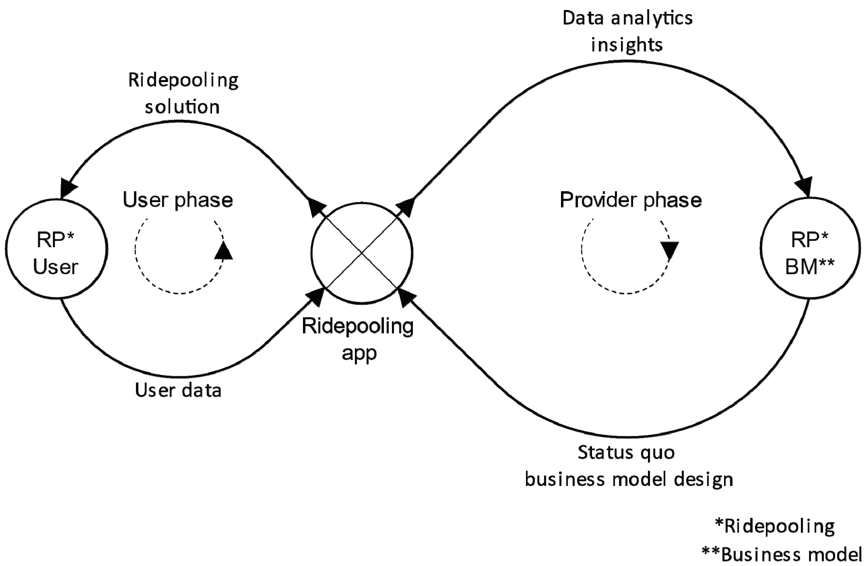

Figure 57: Application of BMC meta-model to 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The BMC meta-model can be applied to all real-world business models that should be designed and changed dynamically and with focus on the user. The meta-model does not show any activity that lies within the components. Therefore, only phases, components, and input/output streams are discussed.[825] Within the **user phase**, the customer uses ridepooling services and provides real-time usage data (e.g. start and destination of ride) while using the service. A feedback option is available per email (sent through the app). Additionally, periodic and anonymized user surveys are carried out (anonymized profile data). These data are collected through the touch point between user and provider (the 'ridepooling in city x' mobile app). The 'ridepooling in city x' business model is still in its testing phase,[826] so users can register as beta testers. Therefore, the ridepooling solution is a business model prototype. Nohroudi describes the **provider phase** as a procedure where strategic management activities take place. The user data are processed, and the insights of data analytics are applied to the business model. If the ridepooling solution changes, then this status quo of the business model design is implemented into the 'ridepooling in city x' app.[827] In this case study, more de-

[825] See chapter 5.2.
[826] Until the end of 2019. Refer to Nohroudi interview 2019.
[827] For this paragraph, refer to Nohroudi interview 2019.

tails about business model design and change were revealed during the expert interview. These are discussed in chapters 6.3.3.2 and 6.3.3.3.

The expert interview also revealed **matches and mismatches** in the design and change process of the unit of analysis and the BMC meta-model. These were identified through comparing dynamic criteria (continuousness, interdependency, simultaneousness) with the theoretical model and the real-life case. door2door installed a *continuously* running circular feedback loop that enabled communication and interaction between user and app, i.e. providing ridepooling solution and collecting user data. This configuration enabled prototyping (business model design[828]) and observation (business model change[829]). Here, there is a match between the theoretical model and the real-world case. However, door2door solely collects anonymized, real-time usage data and anonymized profiles within the observation procedure (a mismatch).

The user phase runs *simultaneously* to the provider phase because two different units work on these procedures (match). But these phases are not fully *interdependent* since Nohroudi did not describe automated procedures of business model change analysis and conceptualization. This describes a procedural mismatch in business model change.

6.3.3.2 Application of BMC sub-model to ‘ridepooling in city x’ business model

The BMC sub-model pre-defines core business model components that can be used in digitalized business models.[830] The model describes each component’s activities as abstract steps in a procedure. Input/output streams between components are specified with reference to digitalized business models.

The ‘ridepooling in city x’ business model provides a mobile app for digital communication between user and provider. The marketed ridepooling solution contains non-physical services (the shared ride from A to B) and digital services (e.g. booking and payment) that are referred to as ridepooling services. Together, the ridepooling services are the ridepooling solution. ‘ridepooling in city x’ has a digitalized business model.

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[828] See chapter 3.2.4.3 for business model design activities.

[829] See chapter 3.2.4.2 for business model change activities.

[830] Within this dissertation, *digitalized business models* are understood as business models that incorporate technical facilities for a digital communication and interaction between user and provider. Solutions that are marketed within these types of business models can still include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop), and digital services (e.g. providing car software download for autonomous driving).

Point of use (PoU)

Customers use ridepooling services wherever they are. They choose the ridepooling solution from the ‘ridepooling in city x’ app and are navigated to the next digital stop where a driver picks them up. Nohroudi compares this to customer self-service at a digital shelf. During the ‘ridepooling in city x’ testing phase,[831] user profiles only contain data that are necessary to use the ridepooling service (e.g. name, payment data). door2door sends push notifications to the user’s smartphone, but the messages are not individualized. Moreover, the provider collects real-time usage data whenever the app is used, including during the ride itself. To date, the user has not been able to send profile data, specific demands, or problems in real-time. Feedback can be given by email (through an app link). Additionally, periodic and anonymized user surveys are carried out.[832]

In Figure 58, Nohroudi’s description of the use process is transferred to the *PoU component* of the BMC sub-model. ‘Dynamic’ and ‘user-centric’ are criteria for interpreting the findings. The BMC sub-model configuration requirements in chapter 5.3.1 show that the *behavioral customer model* must have these attributes in the PoU component. Use of the app is the use process where the value in use is unfolding.[833] The customer self-service is a pull activity, which is an essential mechanism of the behavioral customer model.[834] Collection of user data by the provider is a push activity, and is the observation activity of business model change. The signaling of user data describes the user’s pull activity. Both are understood as the user observation procedure as a part of business model change.[835] Testing the ridepooling service is the prototyping part of business model design.[836]

[831] Until January 2020 the ‘ridepooling in city x’ business model prototype is being tested. Refer to Nohroudi interview 2019.

[832] Refer to Nohroudi interview 2019.

[833] Refer to Vargo et al. 2008, 148.

[834] Refer to Weiber et al. 2011, 118–119.

[835] See chapter 3.2.4.2 for business model change activities.

[836] See chapter 3.2.4.3 for business model design activities.

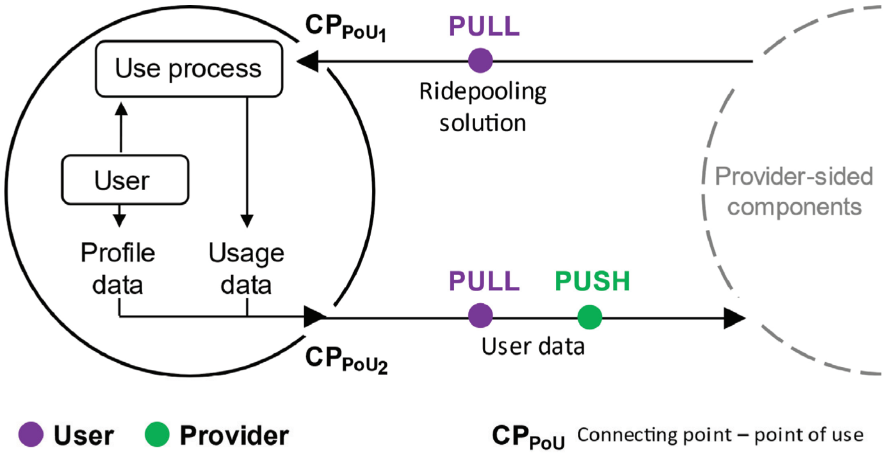

Figure 58: Application of BMC sub-model PoU to 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The expert interview revealed *matches* and *mismatches* in the design and change process of the unit of analysis and the BMC sub-model. The 'ridepooling in city x' app allows the user and provider to interact (a match). Although the app can send push notifications, door2door does not push customized solutions into the use process (provider integration[837]). This is because no individual profile data have been collected. In addition, users cannot send profile data or specific demands in real-time (a mismatch). Nevertheless, feedback via email as well as periodic and anonymized user surveys are subsumed under the category of anonymized profile data.

Value development

Monitoring the customer is vital to door2door. User data are invaluable to change and design the 'ridepooling in city x' business model. However, the user cannot actively send knowledge or other assets through the app. Context data are also purchased from third-party data providers. Nohroudi explained that initial business model design is based on these context data, such as anonymous location data from mobile network operators or historic weather data, because no real-time usage data were collected. After big data analysis, simulation software derives an initial operating concept. This concept shows where future demand will be highest, what levels of capacity utilization can be expected, how many vehicles and drivers will be needed, and what operating

[837] See chapter 3.3.1.4 for the behavioral customer model and the provider integration approach.

times make sense. In addition, the current legal situation plays a decisive role in the 'ridepooling in city x' business model. Operating ridepooling services requires a legal license, and the laws concerning on-demand passenger transport will probably be amended in the future. Nohroudi has identified the law as an important external factor in the business model environment, which must be monitored. Business model change is initiated when data analytics highlight that change is needed. Machine learning is essential for algorithm development. But this change procedure has not been automated yet. door2door use data analytics and simulation to either develop a new business model design or redefine the business model design. Examples of the case study change and design process are given in chapter 6.3.4.[838]

In Figure 59, Nohroudi's description of data collection and business model change is transferred to the *value development component* of the BMC sub-model. The attributes 'dynamic' and 'user-centric' are important features of value development and define the user interface and big data analytics. User data are collected by the user interface ('ridepooling in city x' app). Externally purchased data are transferred to big data analytics. Data collection is an observation activity in business model change. door2door use big data analytics and machine learning to develop their algorithms. They also use their own simulation software 'Insights' to develop detailed operating concepts.[839]

[838] For this paragraph, refer to Nohroudi interview 2019.
[839] See chapter 3.2.4.2 for business model change activities.

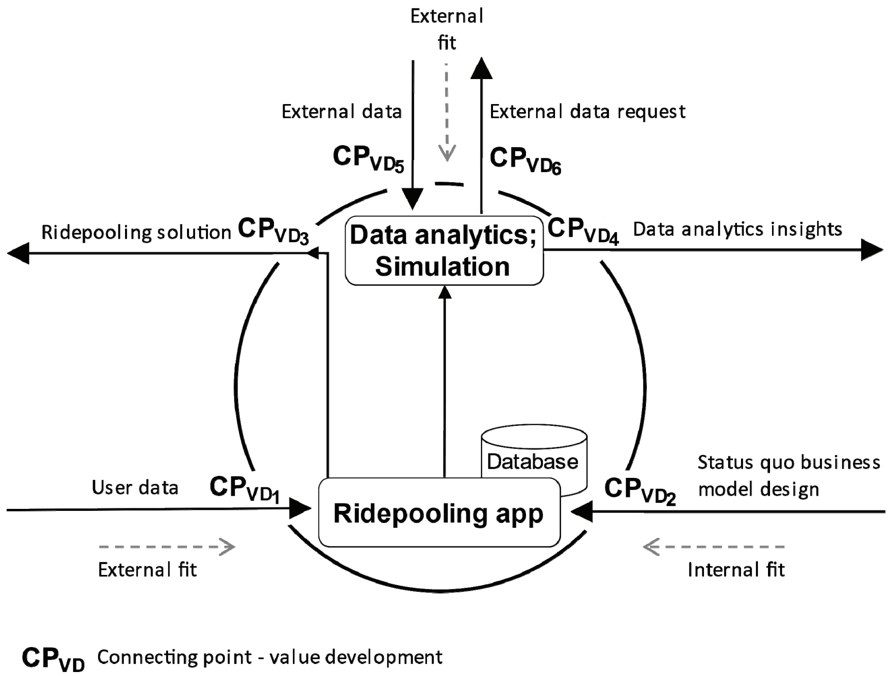

Figure 59: Application of BMC sub-model value development component to the ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

The expert interview revealed *matches* and *mismatches* between the unit of analysis and the BMC sub-model value development component. User data collection through a *user interface* is a match. Users cannot send knowledge or other assets through the app so are not active co-creators of value (a mismatch).[840] Observation activities apply not only to users but also to other external factors (e.g. law). The BMC sub-model does not monitor external factors other than the user. This represents a mismatch between the theoretical model and the case study. The installation of a *data analytics* process is a match. Although simulation software was not used in the original BMC sub-model, it is a software technology that is dependent on big data analytics. Therefore, analysis activities within the BMC sub-model match the business model change activities of the unit of analysis. In the interview, big data analytics did not reveal algorithms that suggest a specific type of business model change. Also, an automated connection between big data analytics and the conceptualization of business model change is not implemented

[840] Profile data that are collected through email feedback or consumer surveys is anonymized and too infrequent to be essential for an active value co-creation process.

into the unit of analysis. At door2door, the insights of data analytics are transferred to a strategic unit for further assessment (conceptualization). This highlights a mismatch in business model change between the BMC sub-model and the unit of analysis. However, the BMC sub-model and the case study both have interdependent internal and external fit. Changes to the door2door business model can be triggered by external factors and are based on the current business model design (status quo).

Value proposition

door2door's business model design process focuses on prototyping. The initial operating concept (result of simulation) provided the base for the business model prototype. Nohroudi explained that firm x developed a marketing concept including the groups of customers they wanted to target and the value they wanted to propose with their new offering. The offering was designed based on the marketing and the operating concept.[841]

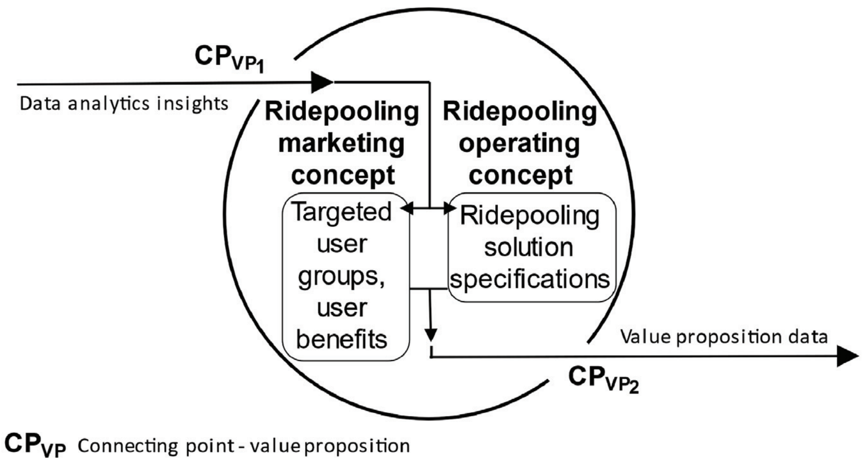

Figure 60: Application of BMC sub-model value proposition to 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

In Figure 60, the expert's description of the value proposition design process is transferred to the *value proposition component* of the BMC sub-model. Again, 'dynamic' and 'user-centric' are criteria for interpreting the findings. As shown in chapter 5.3.1, these attributes define two features that must be considered for value proposition: (1) user

[841] For this paragraph, refer to Nohroudi interview 2019.

segments, user benefits, and solution specifications that are influenced by the user (as external factor) and are designed with dynamic consistency; and (2) user-centric, mixed-criteria segmentation. Insights from data analytics help define targeted user groups, user benefits, and the specifications of the ridepooling solution.

The expert interview revealed *matches* and *mismatches* between the unit of analysis and the BMC sub-model value proposition component. First the *external factors* were not solely user-centric. Insights from data analytics contain other data, such as third-party context data and legal specifications. The BMC sub-model is configured around user centricity and does not consider external factors other than users. This results in a mismatch between the theoretical model and the case study. The door2door business model considers the same *value proposition elements* and design activities as the BMC sub-model, which is a match. However, the concurrent sequence of design activities in the case study is different to the linear sequence in the BMC sub-model (a mismatch). This is probably because two players (door2door and firm x) are involved in the process of value proposition design. However, both design approaches guarantee *dynamic consistency* because they consider the influence of external factors on value proposition design. The interview did not reveal whether a user-centric, mixed-criteria segmentation approach was applied (a mismatch). Therefore, user segments from secondary data analysis were used to configure the business model in chapter 6.3.2 according to information about targeted users given in the interview.

Value creation and distribution

The 'ridepooling in city x' business model has been designed and changed collaboratively. door2door and their customer firm x offer a ridepooling solution to their customers. The user is familiar with the firm x brand. door2door does not appear to the customer but hosts, operates, and develops the ridepooling platform as agreed in the contract with firm x. User data are available to firm x through a multi-tenancy architecture. door2door is also responsible for the supplier and manages the stakeholder/gatekeeper. Users can send feedback via email, but they do not actively co-create value.[842]

'Dynamic' and 'user-centric' are criteria for interpreting the findings. Chapter 5.3.1 described two important features of value creation and distribution: (1) network setup (as-

[842] For this paragraph, refer to Nohroudi interview 2019.

sets, roles, deliverables, and transactions) that is influenced by the user and is dynamically consistent; and (2) integration of users and their assets as co-creators of value.

Figure 61 presents the value network setup of the 'ridepooling in city x' business model from the perspective of door2door.

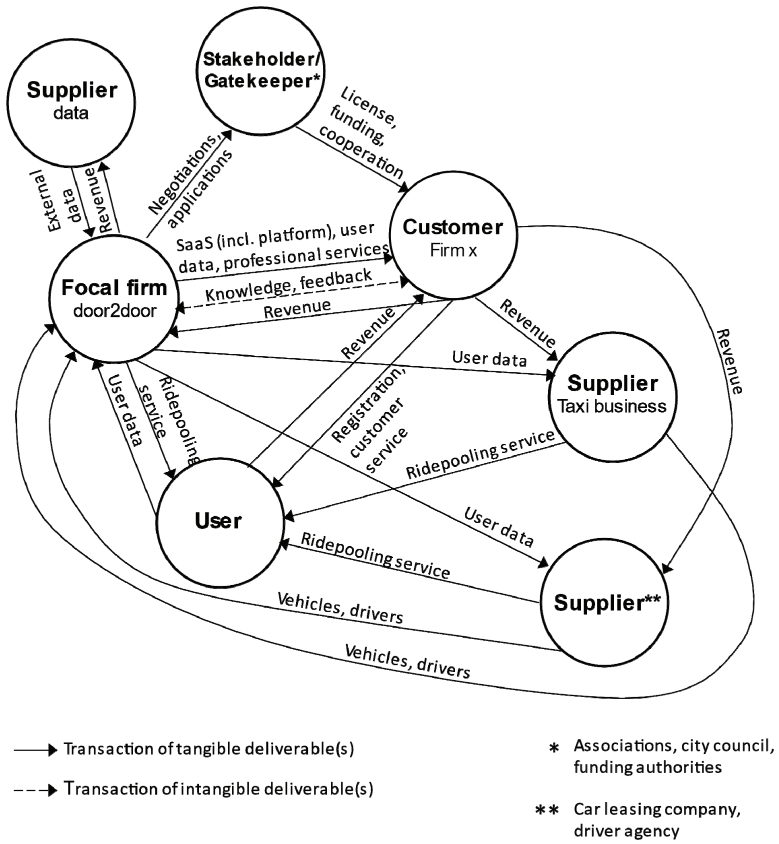

Figure 61: Application of BMC sub-model value network setup to 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019; Allee 2009, 435–437.

This graphical overview of the network shows roles (e.g. focal firm), deliverables (e.g. ridepooling service), and transactions (e.g. focal firm provides ridepooling service to user);[843] assets are not depicted.

[843] See chapter 5.3.4.4 for value network setups. The tangible deliverable 'revenue' must be differentiated into direct/indirect and transaction-dependent/-independent revenue streams. This distinction is made within the text, but not in the visual. See also chapter 3.1.2 and Table 2 in particular for different types of revenue.

The focal firm (door2door) transfers SaaS, including hosting, operating, and developing the ridepooling platform, user data (multi-tenancy platform), professional services,[844] knowledge, and feedback (intangible) to firm x. Firm x also exchanges knowledge and feedback, and pays door2door a transaction-independent, direct set up and hosting fee.[845] As part of their professional services, door2door negotiates with important stakeholders and gatekeepers and deals with ridepooling operating licenses. These deliverables are tangible because they are part of the contract with firm x.[846] Stakeholders and gatekeepers (associations, city councils, and funding authorities) transfer the corresponding license, funding, and cooperation (willingness) to firm x in return. Data suppliers provide external data (e.g. anonymous location data, weather data) to door2door and receive direct, transaction-dependent revenue in return. door2door provide digital ridepooling services (e.g. booking, payment) to the user, and users pay a transaction-dependent, direct fee to firm x (via the ‘ridepooling in city x’ app) and their user data are collected by door2door. Firm x provides customer service and registers users for ridepooling services. A taxi business, car rental company, and driver agency are among the value network’s suppliers. They provide ridepooling services to the user and vehicle and driver capacities to door2door. The focal firm transfers user data (e.g. booking, user location) to these suppliers so that they have the relevant information to properly carry out the ridepooling service. Suppliers receive direct, transaction-dependent revenue for providing the ridepooling service, or a direct, transaction-independent compensation for providing assets (e.g. leased vehicles).

According to the expert interview’s findings, in this case study, value creation and distribution (i.e. the value *network setup*) did not have major mismatches in sequence or designed elements (assets, roles, deliverables, and transactions). But the *integration of users* and their assets into the value network was not applied to the unit of analysis. As shown in Figure 61, user data were collected and analyzed for business model design and change. Beyond that, users and their active assets (e.g. knowledge, creativity) were not actively integrated as a deliverable into the value network (mismatch between the case study and BMC sub-model).

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[844] For example, stakeholder and supplier management, license and funding application, project management. Refer to Nohroudi interview 2019.

[845] See chapter 3.1.2 for a classification of research streams, Table 2 in particular.

[846] See chapter 5.3.4.4 for the difference between tangible and intangible deliverables.

6.3.3.3 Application of modeled instance of the BMC to 'ridepooling in city x' business model

The BPMN business process (modeled instance of the BMC, chapter 5.4.3) is applied to the unit of analysis. The data that were collected through the expert interview, offer a guidance for this application. However, the BPMN-modeled process provides a simplified version of door2door's business processes.

'Ridepooling in city x' business process: user phase

Figure 62 illustrates the BPMN 2.0-modeled user phase of the modeled instance of the BMC that is applied to the unit of analysis.

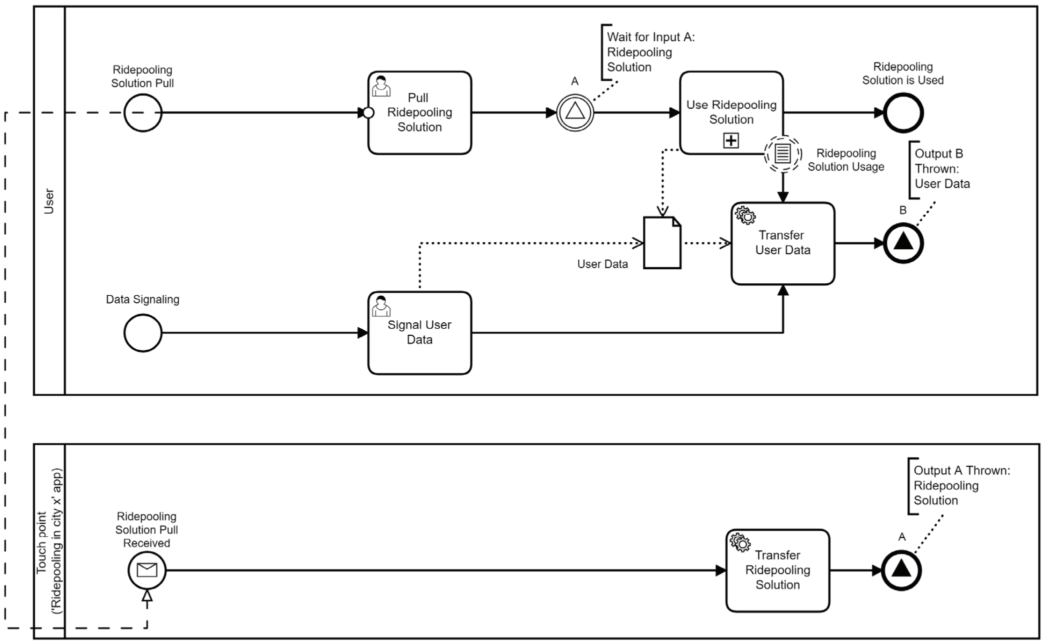

Figure 62: Application of BPMN-modeled user phase to 'ridepooling in city x' business model. Adapted from Nohroudi interview 2019.

User pulls ridepooling solution

If the user decides to pull a ridepooling solution from the 'ridepooling in city x' app, the user phase begins at *Ridepooling Solution Pull*. Immediately, an instance of the business process is generated, and a token moves down the sequence flow. *Pull Ridepooling Solution* is completed by choosing and requesting a solution from the provided offerings (e.g. book a ridepooling shuttle). A message is sent to the 'ridepooling in city x' app pool through a message flow (dashed line with open arrowhead), which requests delivery of the chosen solution. *Ridepooling Solution Pull Received* is triggered by the message containing the user shuttle booking. The touch point ('ridepooling in city x' app) receives the request. The start event initiates a new instance of the user phase and the token moves down the sequence flow to *Transfer Ridepooling Solution*.

Provider transfers ridepooling solution

The process token travels to *Transfer Ridepooling Solution*, which is where the solution is automatically transferred to the user. Here, the touch point transfers the booking information to the suppliers (subprocess not illustrated). The service task is completed once the ridepooling booking is transferred to the supplier. The subsequent throwing signal end event *A* (indicated by the black triangle) broadcasts the successful ridepooling booking on to the user pool. At this point, the process instance within the touch point pool ends.

After the request message is sent to the touch point, the token moves further down the sequence flow and arrives at the catching intermediate signal event *A* (indicated by the white triangle), which is when the user is waiting for the requested ridepooling solution, i.e. input *A*. The triangle that is embedded into the circular event marks a signal trigger. The event is triggered the moment the requested solution is successfully transferred to the user, i.e. when the booking is confirmed by the 'ridepooling in city x' app.

User uses ridepooling solution

The next user task is *Use Ridepooling Solution*. The ridepooling solution is used with assistance of the 'ridepooling in city x' app and completed when the use process ends (e.g. booking → routing to digital stop → ridepooling → arrival → payment). Real-time usage data is generated (start and destination, ride started as requested?, waiting times, duration of ride, driven route, vehicle occupancy, price paid, and context information).[847] Outgoing data mark the flow of these *User Data*. The transfer of user feedback via email and periodic and anonymized user surveys is subsumed under the category of anonymized profile data. Once *Use Ridepooling Solution* is completed, i.e. the user arrives at their destination and pays the ride, this process instance within the user pool finishes at *Ridepooling Solution is Used.*

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[847] Refer to Nohroudi interview 2019.

Transfer of user data

The service task *Transfer User Data* is not carried out by the user since it is automated transfer of user data. In the 'ridepooling in city x' business model, data is transferred via a stream processing framework and is stored in the touch point/database. The transfer also requires the user's permission for further anonymized data processing. Although data transfer is automated, the user gives consent and approves the privacy policy in advance to permit anonymized future transactions.[848] The service task *Transfer User Data* has one incoming data association flow which carries a *User Data* object.

[848] For this paragraph, refer to Nohroudi interview 2019.

'Ridepooling in city x' business process: provider phase

Figure 63 illustrates the BPMN 2.0-modeled provider phase of the modeled instance of the BMC that is applied to the unit of analysis.

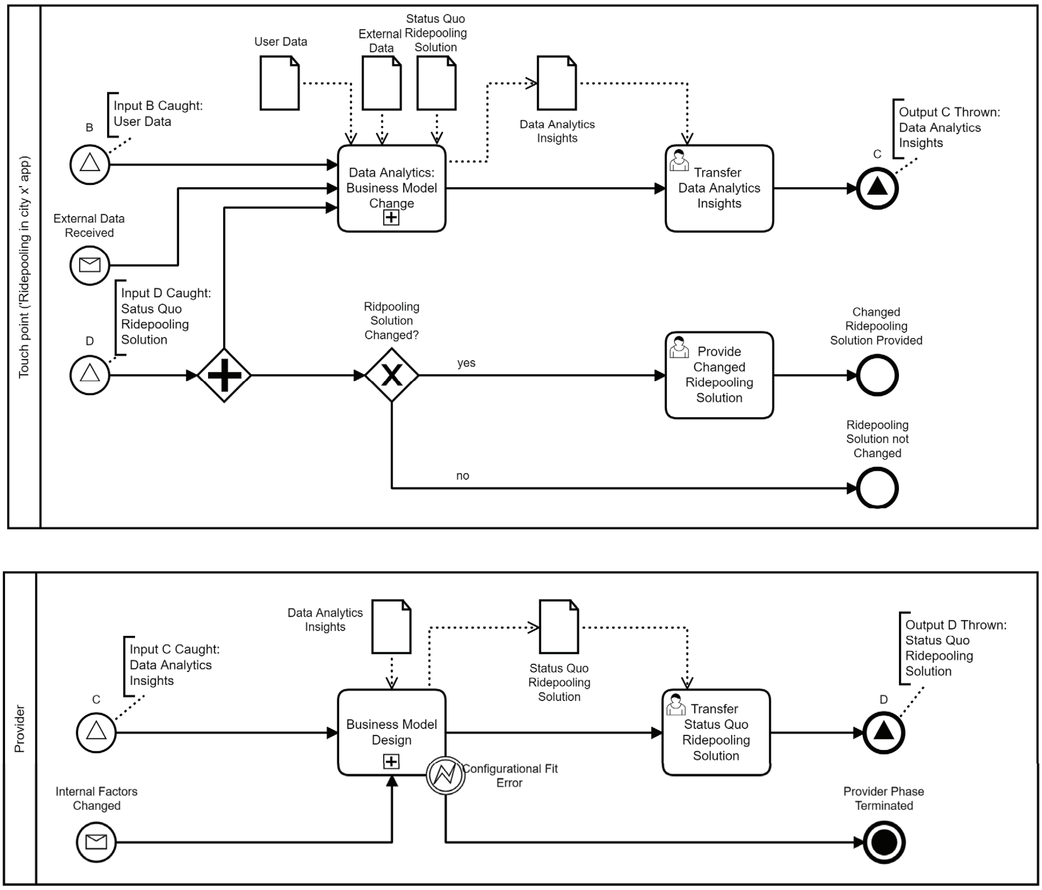

Figure 63: Application of BPMN-modeled provider phase to 'ridepooling in city x' business model. Adapted from Nohroudi interview 2019.

Starting the provider phase

The catching signal start event *B*, the catching signal start event *D,* and the catching message start event *External Data Received* initiate a new instance of the provider phase. The event is triggered when a signal broadcasts the input of *User Data*, *Status Quo Business Model Design*, or *External Data*.

The signal on transferred *User Data* is thrown from the touch point pool within the user phase; the signal on transferred *Status Quo Business Model Design* is thrown from the provider pool within the provider phase, and the signal on *External Data* is thrown by an external message. The signal *B* represents the first link between the user phase and provider phase.

Provider conducts data analytics

The events generate a token that travels down two separate sequence flows, both arriving at *Data Analytics: Business Model Change*, which enables big data analytics and simulation. Three data associations connect a *User Data*, an *External Data*, and a *Status Quo Business Model Design* object to the subprocess. The subprocess can access these data and external data (e.g. anonymous location data from mobile network operators). Figure 64 shows the expanded data analytics subprocess that automatically receives these three data objects. In this process instance, these data objects act as input data for the whole subprocess and its activities. *Start Data Analytics* initiates the subprocess and sends a token to *Conduct Data Analytics*, which is operated by an algorithm that is enhanced with machine learning.[849]

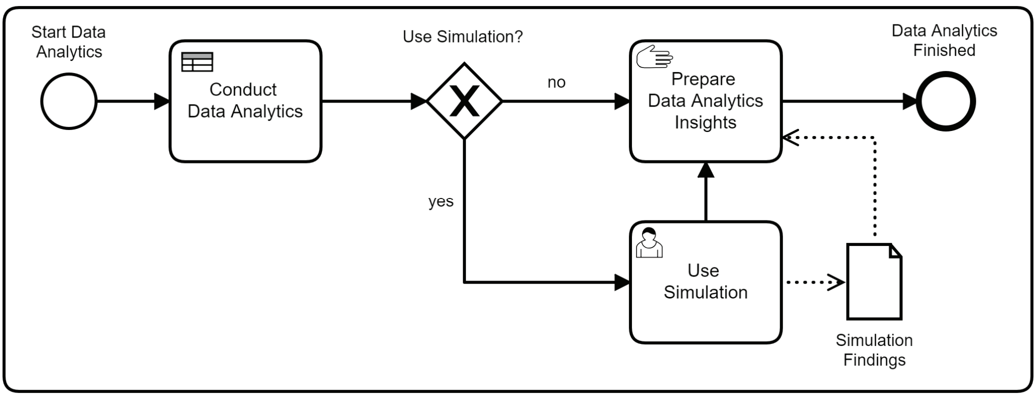

Figure 64: Application of BPMN-modeled expanded business model change data analytics subprocess to 'ridepooling in city x' business model.
Adapted from Nohroudi interview 2019.

This process evaluates data from the *User Data*, an *External Data*, and a *Status Quo Business Model Design* objects and compares them with the current operating system. The operating concept is an integral part of the value proposition, and is designed by simulation software to predict future demands.[850] It describes the optimal match between demand and supply for ridepooling operations. The operating system helps plan

[849] Refer to Nohroudi interview 2019.
[850] See chapter 6.3.2 for the design of the 'ridepooling in city x' value proposition.

future demand, the levels of capacity utilization, the number of needed vehicles/drivers, and operating times.[851] Door2door's data analytics engine can process data in real-time. This includes cleaning, aggregating, analyzing (mostly pattern detection), and modeling the datasets.[852] Depending on the amount and quality of insights from data analytics, a simulation is conducted (exclusive gateway *Use Simulation?*). If a simulation was run, the *Simulation Findings* are transferred to the manual task *Prepare Data Analytics Insights*. Nohroudi pointed out that these insights are used to adapt the operating concept or to change other parts of the business model (e.g. pricing model).[853] In this process activity, insights are examined by a strategic unit for further assessment. The type of business model change is not determined by algorithms but by door2door employees.

The token exits the *Data Analytics: Business Model Change* subprocess before it travels down the sequence flow to user task *Transfer Data Analytics Insights* (Figure 63). Here, insights from data analytics are transferred by a human. The task has one incoming data association flow, which carries a *Data Analytics Insights* object. This data is the output of the *Data Analytics: Business Model Change* subprocess. Once the task is completed, the touch point pool process instance finishes at the throwing signal end event *'C'*. When the token arrives, the end event immediately throws a broadcast signal, which indicates the successful transfer of output C (*Data Analytics Insights*).

Provider updates ridepooling solution

The sequence flow attached to catching signal start event *D* splits into two separate sequence flows with two cloned tokens in a parallel gateway. One of the cloned process tokens arrives at the exclusive gateway *Ridepooling Solution Changed?* which can initiate an activity to provide a different ridepooling solution in the 'ridepooling in city x' app. This represents the second link between the user phase and provider phase because it provides market-ready ridepooling solutions to the user. Altered business model designs that impact the solution offering are immediately implemented into the 'ridepooling in city x' app.

Provider designs business model

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[851] For this paragraph, refer to Nohroudi interview 2019.

[852] Further details of this sensitive process were not mentioned in the expert interview. Refer to Nohroudi interview 2019.

[853] Refer to Nohroudi interview 2019.

The triggered design activity involves specified activities to design a business model. The *Internal Factors Changed* start event is triggered by a message. These changes are not connected to the changing business environment (external factors). At door2door, internal factors do not play a major role in business model design, but important management decisions are always implemented in the design of the current business model.[854]

The catching signal start event *C* can also initiate a new instance of the provider phase within the provider pool. The event is triggered when a signal broadcasts the input of *Data Analytics Insights*. If *Business Model Design* subprocess is started by the catching signal start event *C* it receives the data object *Data Analytics Insights* from its parent process. The data object acts as input data for the whole subprocess and its activities.

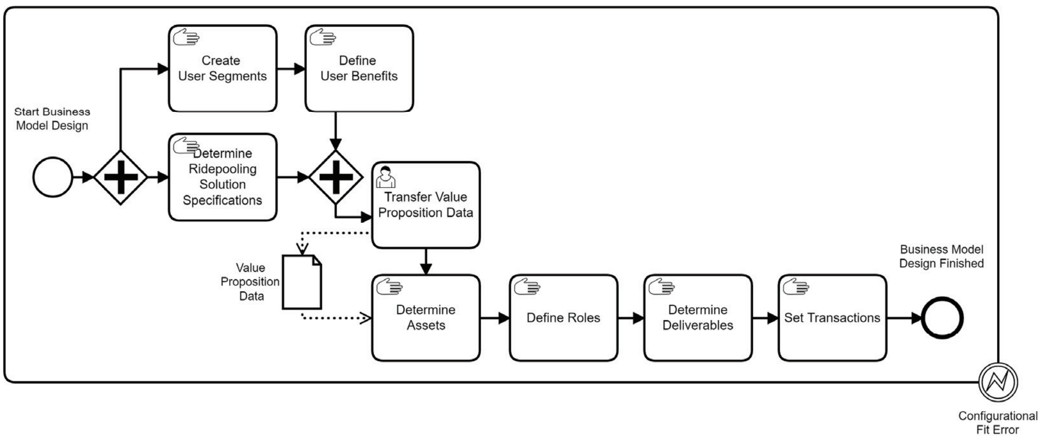

Figure 65: Application of BPMN-modeled expanded business model design subprocess to ‘ridepooling in city x’ business model.
Adapted from Nohroudi interview 2019.

The expanded subprocess features value proposition and value creation and distribution (Figure 65). Manual tasks within the subprocess are performed by employees of door2door and firm x. *Start Business Model Design* initiates an instance of the subprocess and the token travels down the sequence flow before it arrives at the parallel gateway. That means that *Create User Segments* (and subsequent manual task *Define User Benefits*) and the *Determine Ridepooling Solution Specifications* start

[854] Refer to Nohroudi interview 2019.

designing the business model's value proposition component simultaneously.[855] When the three tasks are executed, the tokens arrive at a second parallel gateway where value proposition design is completed. *Transfer Value Proposition Data* is executed by employees of door2door and firm x.[856] Subsequent tasks to design value creation and distribution are described in chapter 6.3.3.2. The subprocess is completed when the token arrives at *Business Model Design Finished*.

The catching error interrupting boundary event *Configurational Fit Error* (Figure 65) and its consequences are described in detail in chapter 5.4.3.2. Nohroudi explained that a business model cannot be changed and redesigned over and over again to make it less unprofitable. In the end it remains unprofitable.[857]

When *Design Business Model* ends without interruptions, the token travels down the sequence flow and arrives at *Transfer Status Quo Business Model Design*. A data association carries a *Status Quo Business Model Design* object and connects the subprocess with the user task. The expert interview did not reveal how the data are transferred, but Nohroudi explained that the status quo of the business model design is always the basis for suggested changes.[858]

Matches and mismatches

Application of the modeled instance to the unit of analysis revealed matches and mismatches between the theoretical BMC and the real-life case study. The 'ridepooling in city x' business process diagram was similar to the modeled instance of the BMC in design and change logic (user-centric and dynamic in many instances). The expert interview revealed that door2door design and change activities are similar in content and sequence. One subprocess had different mechanisms: *Data Analytics: Business Model Change*. Algorithms do not determine the necessary business model change automatically, but they reveal discrepancies or patterns that indicate change is needed. At door2door, employees make decisions about the type of business model change.

[855] See chapter 6.3.3.2 for a detailed description of door2door's and firm x's value proposition design activities.

[856] If a software or other technologies are used for this task could not be determined through the expert interview. Therefore, the transfer is rather understood as a process of data aggregation between door2door and firm x. Refer to Nohroudi interview 2019.

[857] Here, Nohroudi describes a business model innovation in 2016. Refer to Nohroudi interview 2016.

[858] Refer to Nohroudi interview 2019.

Another mismatch was detected within the user phase. Data signaling was not fully technologically possible. User feedback can only be sent by mail or collected through consumer surveys. These anonymous data cannot be analyzed in real-time and cannot be assigned to an individual user profile. Usage data are collected in real-time but are anonymous, so the provider cannot individualize solution offerings and push them into the use process.[859] In addition, the user cannot co-create value, e.g. by designing new services with door2door collaboratively.

6.3.4 Explanatory case study findings

6.3.4.1 'Software as a service' (SaaS) business model innovation

Before 2016, door2door offered the 'Ally' trip-planning app. A B2C business model that addressed users who organized their multimodal and intermodal trips through the mobile app 'Ally'. In 2016, door2door faced a major upheaval. The 'Ally' business model at the time did not have good prospects. door2door changed the business model drastically, and had developed their 'software as a service' (SaaS) B2B business model. 'SaaS' described the key service provided by door2door: selling software and additional professional services to business customers. The focus of this dissertation is the 2019 'ridepooling in city x' business model in cooperation with door2door customer firm x. 'Ridepooling in city x' is a real-life, networked version of the 'SaaS' business model – the solution is the ridepooling service and the end user is the focus of attention within the value network (B2C).[860] Door2door's B2B 'SaaS' business model explains the change and design process that took place in 2016.

Business model innovation in 2016

In the following chapter, the radical business model innovation that occurred in 2016 is described. First, the indicators of value change and the value transition process (value development) are examined. Second, outcomes of value change (business model innovation) and the design process are discussed. Finally, the design and change activities that maintained door2door's competitive advantage are highlighted.

In 2016, door2door's *indicators of value change* were user data, sales figures, cost structures, and industry/market data. User data included specific user activities (e.g. trip's

[859] See chapters 3.3.1.4 and 5.3.4.1 for pull/push mechanisms with the behavioral customer model.
[860] For this paragraph, refer to Nohroudi interview 2016; Nohroudi interview 2019.

planned), app engagement (e.g. how many times a user opens the app, the duration of use, and what actions a user takes within an app), and monetization through the app (e.g. advertisement impressions/clicks). Data about market competitors and their business models helped door2door determine the market's size and potential, and their own position in the market.[861]

In the *value transition process*, data were collected and analyzed. The decision to change the business model was based on the results of data analytics, and the business model change was conceptualized. Analysis of real-time usage data combined with sales figures and customer acquisition cost revealed a negative difference of 'customer lifetime value' and 'customer acquisition cost'; in other words, the cost for door2door to make a user install and actively use the 'Ally' trip-planning app were higher than the generated revenue within three years – the profit share was too low. door2door realized that their business model was a hybrid between Google maps ("[…] overarching information aggregator […]"[862]) and local transport companies ("[…] local champions […]"[863]) with a fixed customer base and a well-received trip planning and ticketing app. The competitive environment showed that door2door's 'Ally' business model did not suit the market, and they decided to radically innovate it.[864]

The *outcome of value change* was a conceptualization of business model innovation, which led to the 'SaaS' business model design (Table 14).

Value change criteria	**Business model innovation**	**door2door 'SaaS' business model innovation in 2016**
Planned outcome	*Disrupt market conditions*	'SaaS' business model disrupts conditions in the German ridepooling market (multitenancy architecture in particular)
Scope of change (business model components affected)	*Wide*	All business model components were affected
Degree of radicalness	*Radical*	Radical change to all business model components, solely assets were transferred to the new business model
Frequency of change	*Infrequent*	The first radical business model innovation since 2012
Degree of novelty	*Must be novel to the business or industry*	Business model is novel to the public transportation industry

Table 14: Value change outcome of the door2door business model innovation in 2016.
Adapted from Saebi 2015, 150; Nohroudi interview 2019.

[861] For this paragraph, refer to Nohroudi interview 2016.
[862] Nohroudi interview 2016, translated from German.
[863] Nohroudi interview 2016.
[864] For this paragraph, refer to Nohroudi interview 2016; Nohroudi interview 2019.

The *planned outcome* was a B2B 'SaaS' business model. This disrupted the German ridepooling market because it offered a white-label ridepooling platform with a multi-tenancy architecture. The problem with many platform providers is that they digitally integrate different mobility services (including access and ticketing) under their own brand. The participating mobility providers can benefit from this additional sales channel, but in most cases, they cannot access the user data that were generated through platform use. door2door designed a value proposition that offered a platform solution adapted to the needs of the business customer (white-label). The platform also distributed user data throughout the value network (multi tenancy architecture). The overall business model design was based on this value change. The *scope of change* was wide because all business model components were affected by the innovation. The business model design focused on the B2B customer who needs an easy-to-implement, failure-resistant ridepooling solution that can be adapted to user needs (B2C) and that meets transportation laws. door2door's business model design outcome was a one-stop shop for ridepooling services. The change was also *radical* since all business model components and underlying elements were redesigned. door2door's fundamental assets (software/codes/algorithms, data analytics, employees, knowledge) were transferred to the new business model design. This was the first radical business model change since door2door was founded in 2012, suggesting this was an *infrequent* event. The B2B business model was especially *novel to the public transportation industry* since door2door also offered industry-related expert services (e.g. acquisition of licenses and funding in the transportation market).[865]

Linking the findings of the expert interview to the case study

Nohroudi explained that radical innovation was necessary in 2016 because the 'Ally' business model was not profitable. Industry and competitor analysis showed that their business model was a hybrid of information aggregators (Google maps) and local companies with a user segment that is too small to be profitable. Although the changes were radical, door2door were able to transfer all their assets to the new business model design and quickly develop new assets (e.g. expert knowledge about licensing and funding for public transportation) that were crucial to the new business model.[866]

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[865] For this paragraph, refer to Nohroudi interview 2016; Nohroudi interview 2019.
[866] For this paragraph, refer to Nohroudi interview 2016; Nohroudi interview 2019.

The case study proposition is: Dynamic, user-centric business model design and change is crucial to developing and sustaining a competitive advantage. The design and change processes for developing and sustaining a competitive advantage were examined, and the competitive advantage was operationalized and evaluated. According to the causal chain described in chapter 6.1.2, door2door's *business model change and design activities were successful* in sustaining (and also refining)[867] their competitive advantage because assets were not lost and the business was not liquidated. *Crucial activities in the business model change and design process* were real-time data analytics and industry and competitor analysis. Data analytics is also crucial to the BMC. The continuousness of real-time data analytics implies *dynamic design and change* of business models. Usage data were used as indicators for value change and business model design, so the process was *user-centric*.

To increase the internal validity, *rival explanations* for developing and sustaining a competitive advantage must be considered. Collection and analysis of industry data (with specific focus on competitor's business models) is not part of the BMC logic, so offers a rival explanation for successful business model design and change.

6.3.4.2 'Ridepooling in city x' business model adaptation

In July 2018, testing of the 'ridepooling in city x' business model began, and several minor changes were made.[868] Various adaptations to the business model are currently in progress and are either during ideation or just before prototyping:[869]

- Easy readability of the 'ridepooling in city x' app for impaired vision and barrier-free rides (prototyping and integration in Q1 2020)
- Pre-booking feature in 'ridepooling in city x' app (ideation)
- Extension of user segments and service area (ideation, prototyping 2020/2021)
- Dynamic pricing model for multimodal capacity management (ideation)
- Implementation of individual user profiles into the 'ridepooling in city x' app and offering of individualized solutions (ideation).

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[867] See chapter 6.3.2 for the new value development component (new indicators of value change, redefined value transition process) of the new 'ridepooling in city x' business model.

[868] See chapter 6.3.4.3 for 'ridepooling in city x' business model evolution.

[869] Refer to Nohroudi interview 2019.

The business model adaptation instances (2018-present)[870]

In 2018 and 2019, door2door's *indicators of value change* were user data that can be differentiated into usage and profile data. Usage data are, for example, ridepooling start and destination, date and time, ride started as requested?, waiting times, duration of ride, driven route, vehicle occupancy, price paid, context information (e.g. weather, special events, holiday periods). Profile data are user feedback or user surveys, which are anonymized and infrequent. External data were also purchased, such as anonymous location data from mobile network operators, or historical weather data. Other indicators for value change are internal factors such as customer (firm x) feedback and decisions.[871]

door2door's *value transition process* identifies unmet user needs, or other changed external factors and involves different software technologies: data streaming (by a stream processing framework), data analytics (including machine learning), and simulation. The firm's objective is to adapt the 'ridepooling in city x' marketing and operating concept (value proposition),[872] and/or the value network (value creation and distribution), and/or value development according to the findings of the value transition process.[873]

door2door uses diverse types of data when it comes to (1) sensing and conceptualizing business model change (adaptation), and (2) creating a suitable business model design (Table 15).

[870] The same procedure of investigation is used as in chapter 6.3.4.1.
[871] For this paragraph, refer to Nohroudi interview 2019.
[872] See chapter 6.3.2, Figure 54 in particular for value proposition of 'ridepooling in city x' business model.
[873] For this paragraph, refer to Nohroudi interview 2019.

	Type of data/input	Business model change /design	App for impaired vision and barrier-free rides	Pre-booking	User segment and service area extension	Dynamic pricing	User profiles, individualized offerings
EXTERNAL FACTORS	*Usage data*	*Change*	-	-	Usage data of ridepooling service	Usage data of ridepooling service	-
		Design	Usage data of ridepooling service for simulating operating concept	Usage data of ridepooling service for simulating operating concept	Usage data of ridepooling service for simulating operating concept	Usage data of ridepooling service for simulating operating concept	-
	Profile data	*Change*	User feedback	User feedback	User feedback, consumer survey	-	-
		Design	User feedback	User feedback	User feedback, consumer survey	-	-
	External data	*Change*	Legal requirements taxi market	Feature in taxi/rental business	-	Data on capacities in public transport	-
		Design	-	-	Anonymous location data from mobile network operators for simulating operating concept	Data on capacities in public transport for simulating operating concept	-
INTERNAL FACTORS	*Customer management decisions, feedback*	*Change*	Customer (firm x) management decision	-	Customer (firm x) management decision	Customer (firm x) feedback	Customer (firm x) feedback
		Design	-	-	-	Customer (firm x) feedback	Customer (firm x) feedback

Table 15: Types of data used for ‘ridepooling in city x’ business model adaptation and design. Adapted from Nohroudi interview 2019.

Prototyping or integration of the following new business model designs have not been decided or started yet. User feedback at the beginning of the test phase already showed that a *barrier-free app and rides* were needed. The firm x management decided to implement this adaptation to ensure social inclusion and to meet non-mandatory legal requirements. To adapt the operating concept and the network setup (e.g. additional barrier-free vehicles), transferable usage data of the operating ridepooling service were used for simulation. User feedback supported the design of new user segments and benefits. This adapted business model will be integrated in 2020. The ‘ridepooling in city x’ app will be expanded to include a *pre-booking feature*. Early user feedback and analysis of the taxi industry (where pre-booking features are standard) have been decisive in the business model adaptation. Business model adaptation needed user feedback and usage data for simulation with additional pre-bookings. *The user segment and service area extensions* are new solution modules that will be added to the ridepooling service. These modules are replications of the classic ‘ridepooling in city x’ service, but are created for different users (kindergarten children, students, and patients) and operate on different routes, times, or service areas. The decision to adapt the business model was based on different sources: user feedback, consumer survey findings, usage data on routing (first mile and last mile to and from the digital stop), and firm x management decisions. Business model design is based on user feedback, survey findings, transferable ridepooling usage data, and external data, all of which simulate the new operating concept. The business model design is currently in the ideation phase, but prototypes for testing can be expected in 2020/2021. *Dynamic pricing* was a mechanism for multimodal capacity management. The objective was to shift capacity from one mode (ridepooling) to the other (public transport), or vice versa. In public transport peak times, the prices for ridepooling can be lowered. If there is enough capacity on trams, metros, or public buses, users must pay a comfort premium to use ridepooling services. Business model adaptation was initiated by internal factors, i.e. firm x’s feedback on innovative ideas for business model change. To meet individual customer needs, profile and usage data should be assigned to *individual user profiles*. This allows the provider to push *individualized solution offerings* into the use process.[874] Currently, only non-individualized notifications are pushed through the ‘ridepooling in city x’ app. Implementing user profiles would also allow the user to send feedback through the app (at the moment feedback can only be sent by email). This way, user co-creation would be feasible. User assets (e.g. feedback, knowledge, creativity) could be integrated into the value network and utilized to co-create value (e.g. in service design).[875]

[874] See chapter 5.3.4.1 for push/pull mechanisms of the behavioral customer model.
[875] For this paragraph, refer to Nohroudi interview 2019.

The *outcome of value change* is illustrated in Table 16. It describes the conceptualization of business model change for five real-life business model adaptations.

Value change criteria	**Business model adaptation**	**App for impaired vision and barrier-free rides**	**Pre-booking**	**User segment and service area extension**	**Sustainable dynamic pricing**	**User profiles, individualized offerings**
Planned outcome	*Align with the environment*	Meeting needs of visually impaired and physically disabled users	Fulfil user requirements with regard to time-critical trips	Meeting user needs of parents and their children and patients	Prevention of cannibalization effects (public transport - ridepooling) and multimodal capacity management through dynamic pricing; meeting user needs regarding capacity issues	Meeting user needs more precisely through profile data collection and active user integration for value co-creation
*Scope of change**	*Narrow – wide*	Moderate: see Table 17 for business model design outcomes	Narrow: see Table 17 for business model design outcomes	Wide: see Table 17 for business model design outcomes	Moderate: see Table 17 for business model design outcomes	Wide: see Table 17 for business model design outcomes
Degree of radicalness	*Incremental – radical*	Moderate service extension	Incremental service extension	Moderate service extension	Moderate service adaptation	Radical service adaptation
Frequency of change	*Periodical*	Periodical	Periodical	Periodical/infrequent	Periodical/infrequent	Periodical/infrequent
Degree of novelty	*Novelty is not a requirement*	Already implemented in the German taxi/rental market	Already implemented in the German taxi/rental market	Already implemented in the German taxi/rental market	Novelty to the German transportation market	Novelty to the German transportation market

**Business model components affected*

Table 16: Value change outcome regarding door2door business model adaptations (2018-present).
Adapted from Saebi 2015, 150; Nohroudi interview 2019.

The *planned outcome* of these adaptations usually fulfils unmet user needs (value proposition) or improves the process of sensing and meeting user needs (value development). Dynamic pricing, for example, should reduce user’s capacity issues, sustain the firm x eco system (including public transport), and prevent cannibalization through multimodal capacity management. The *scope of change*, *degree of radicalness*, and *frequency of change* correlate with each other: the greater the scope of change, the higher the degree of radicalness, and the lower the frequency of change. The integration and sustainability of dynamic pricing as well as the implementation of user profiles and individualized offerings would be novel to the German transportation market. *Uber*, for example, applied surge pricing to their ridehailing service. When capacity is high, the fare drops, and when capacity is low, the fare increases capacities (e.g. during a special event). ‘Ridepooling in city x’s’ dynamic pricing model distributes capacity with the aim of sustainability, not profitability.[876]

Table 17 lists possible design outcomes of the ‘ridepooling in city x’ business model adaptation. These business model configurations are based on data from the expert interview and are not exhaustive.

	Adaptation of value proposition	**Adaptation of value creation and distribution**	**Adaptation of value development**
App for impaired vision and barrier-free rides	• User segments: visually impaired, physically disabled users • User benefits: independent booking and use of on-demand mobility • Ridepooling solution specifications: barrier-free app/vehicles	• Assets: new software, barrier-free vehicles • Deliverables: barrier-free ridepooling service	-
Pre-booking	• User benefits: reliable service for time-critical trips • Ridepooling solution specifications: pre-booking feature in app	Deliverable: ridepooling service including app feature for pre-booking	-
User segment and service area extension	• User segments: Kindergarten kids, students, patients • User benefits: flexible, comfortable and safe on-demand mobility • Ridepooling solution specifications: new service area, operating times	• Assets: additional vehicles, drivers	-
Dynamic pricing	User benefits: capacity-optimized travelling, optional: pay comfort premium	• Asset: new dynamic pricing algorithm • Deliverables: ridepooling service including dynamic pricing	Value transition process: real-time adaptations of price + capacity-optimized travelling
User profiles, individualized offerings	• User segments: potentially new segmentation • User benefits: individualized offerings, possibility of value co-creation (e.g. in service design) • Ridepooling solution specifications: potentially new specifications	• Assets: new algorithms • Deliverables: ridepooling service including user profiles and individual offerings • Transactions: real-time profile data (User), individualized offerings (door2door)	• Indicators of value change: real-time, not anonymized usage and profile data • Value transition process: real-time reaction to individual customer demands, user integration (co-creation of value)

Table 17: Possible design outcomes of ‘ridepooling in city x’ business model adaptations. Adapted from Nohroudi interview 2019.

User profiles, for example, would allow users to send individual profile and usage data in real-time through the ‘ridepooling in city x’ app,[877] such as direct user feedback or individual preferences regarding the service design. This will generate a new indicator of value change. Datasets would no longer be anonymous, allowing individual profiles to be set up. Behavior or feedback of individual users would become an indicator of value

[876] For this paragraph, refer to Nohroudi interview 2019.
[877] See Figure 34 for user data.

change. Additionally, the value transition process could be expanded by real-time reactions to individual customer demands (provider integration)[878], and user integration, e.g. co-creation of value in service design.[879]

Linking the findings of the expert interview to the case study proposition

Nohroudi emphasized that profile data, such as user feedback or consumer surveys, have an impact on business model adaptation. Usage data and external data are very useful for business model design (especially in combination with door2doors simulation software 'Insights'). Moreover, the feedback and management decisions of firm x are invaluable for business model adaptation. Nohroudi pointed out that, especially in the current testing phase, door2door and firm x are willing to use the trial and error method to evaluate and redefine their business model.[880]

The case study proposition is that dynamic, user-centric business model design and change is crucial to developing and sustaining a competitive advantage.[881] The competitive advantage depends on dynamic consistency between business model core elements where the business model's configurational fit – and thus its effectiveness and performance – is in line with the external dynamics.[882] Since the business model adaptations have either not been decided on or not integrated into a prototype yet, no conclusions can be drawn as to whether these adaptations will sustain dynamic consistency and a competitive advantage. What has been established, however, is that *a dynamic, user-centric design and change process* was applied.[883] The expert interview also revealed a *rival explanation* to the case study proposition. The collection of external data other than user data is not considered in the BMC logic. But external data (such as information on the taxi market, or anonymous location data from network operators) were also used for business model design and change and may also contribute to a competitive advantage.

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[878] See chapters 3.3.1.4 and 5.3.4.1 for the behavioral customer model and provider integration.
[879] For this paragraph, refer to Nohroudi interview 2019.
[880] For this paragraph, refer to Nohroudi interview 2019.
[881] See chapter 6.1.2 for the research design.
[882] Refer to Demil and Lecocq 2010, 241–242.
[883] See chapter 6.3.3 for matches and mismatches between BMC and unit of analysis.

6.3.4.3 'Ridepooling in city x' business model evolution

At the start of the 'ridepooling in city x' business model test phase, the following incremental business model evolutions were made:[884]

- Improved dynamic control of ridepooling vehicles/drivers
- Cooperation with taxi business for capacity management
- Evolution of professional services.

The business model evolution instances (2018-present)[885]

door2door's indicators of value change and their value transition process in 2018 and 2019 are described in chapters 6.3.4.1 and 6.3.4.2. For business model evolution, door2door examined usage data and dynamics within or between business model components (internal factors) to: (1) sense and conceptualize business model change (evolution), and (2) create a suitable business model design (Table 18).[886]

	Type of data/input	Business model change /design	Dynamic control of ridepooling vehicles/drivers	Cooperation with taxi business	Evolution of professional services
EXTERNAL FACTORS	*Usage data*	*Change*	Usage data of ridepooling service	Usage data of ridepooling service	-
		Design	Usage data of ridepooling service for simulating operating concept	Usage data of ridepooling service for simulating operating concept	-
INTERNAL FACTORS	*Dynamics within or between business model components*	*Change*	-	-	Dynamics within business model components (between elements) lead to learning effects
		Design	-	-	Implementation of learning effects into business model design

Table 18: Types of data used for 'ridepooling in city x' business model evolution and design. Adapted from Nohroudi interview 2019.

Analysis of ridepooling usage data revealed some inconsistencies (such as long waiting times or inefficient ridepooling routes). These findings triggered changes to how the ridepooling platform is operated. A more *dynamic and efficient control of vehicle/driver*

884 See chapter 6.3.4.3 for 'ridepooling in city x' business model evolution.
885 The same procedure of investigation is used as in chapter 6.3.4.2.
886 Refer to Nohroudi interview 2019.

distribution was realized through superior algorithms based on big data analytics (usage data). Waiting times and numbers of empty or missed trips decreased. *Cooperation* was also initiated with local taxi businesses because higher ridepooling capacities were needed on certain days and times. Dynamic value creation and distribution had learning effects (e.g. superior knowledge and experience of public transport licenses, working methods, and structures of associations and public institutions). These evolving *professional services* were integrated into the business model design, which affected value creation and distribution (Table 20).[887]

The *planned outcome* of these evolutions are adjustments that increase the overall operational efficiency (Table 19). The *scope of change* is narrow in all three cases since these evolutions have a minor impact on the business model design (Table 20). Since the adjustments are incremental, the *degree of radicalness* is low. The *frequency of change* depends on the type of evolution. Ridepooling capacity extensions are gradual evolutions, while software improvements and learning effects evolve continuously.[888]

Value change criteria	Business model evolution	Dynamic control of ridepooling vehicles/drivers	Cooperation with taxi business	Evolution of professional services
Planned outcome	*Natural, minor adjustments*	Adjustments of ridepooling software	Adjustments of ridepooling capacity	Natural learning effects
*Scope of change**	*Narrow*	Narrow: see Table 20 for business model design outcomes	Narrow: see Table 20 for business model design outcomes	Narrow: see Table 20 for business model design outcomes
Degree of radicalness	*Incremental*	Incremental service extension	Incremental service extension	Incremental service extension
Frequency of change	*Continuous, gradual*	Continuous	Gradual	Continuous

Table 19: Value change outcome regarding door2door business model evolutions (2018-).
Adapted from Saebi 2015, 150; Nohroudi interview 2019.

Table 20 lists the possible design outcomes of 'ridepooling in city x' business model evolution. These business model configurations are based on the expert interview and are not exhaustive.

[887] For this paragraph, refer to Nohroudi interview 2019.
[888] For this paragraph, refer to Nohroudi interview 2019.

	Evolution of value proposition	Evolution of value creation and distribution
Dynamic control of ridepooling vehicles/drivers	User benefits: reliable service, less waiting time	• Assets: superior algorithm • Deliverables: superior SaaS, more liable and efficient ridepooling services
Cooperation with taxi business	User benefit: reliable service	• Assets: taxi vehicles and drivers • Deliverable: ridepooling service with flexible capacity • Transactions: user data (door2door), revenue (firm x), ridepooling service (taxi business)
Evolution of professional services	-	• Assets: knowledge gains through learning effects • Deliverable: superior professional services

Table 20: 'Ridepooling in city x' business model design outcomes through business model evolution.
Adapted from Nohroudi interview 2019.

Linking the findings of the expert interview to the case study proposition

Nohroudi said it is essential to monitor usage data for incremental, but continuous changes. Even though these changes to the 'ridepooling in city x' business model were minor, they increased the quality and usability of ridepooling services and the overall efficiency of the business model. Customer needs for a reliable and convenient on-demand mobility were met through more efficient operation and higher ridepooling capacities. Nohroudi explained that learning effects are created from the inside of the business. They improved door2door's professional services and integrated these refined services into the business model design.[889]

The expert interview showed that business model evolution and subsequent design of the 'ridepooling in city x' business model created a competitive advantage because dynamic consistency was sustained. External forces (user needs) and internal resources (business model design) were brought closer together. There are no *rival explanations* for door2door's business model evolution because no indicators of change or value transition processes were applied that oppose the BMC logic. This implies that a *dynamic, user-centric design and change process* was applied.[890]

[889] For this paragraph, refer to Nohroudi interview 2019.

[890] See chapters 6.3.3 for matches and mismatches between the design and change process of the BMC and the unit of analysis.

6.3.5 Synopsis of case study findings

This chapter will combine the results of the case study's descriptive and explanatory findings.[891] The research questions will be answered, and rival explanations will be examined.

Table 21 illustrates matches and mismatches between business model design and change of the BMC and the unit of analysis. This summarizes the findings of chapter 6.3.3.

		Matches and mismatches between BMC and unit of analysis	
Characteristics of a dynamic and user-centric business model approach		**Matches**	**Mismatches**
***Dynamic*[892]**	*Continuousness*	+ Preconditions ('ridepooling in city x' app, data analytics) for continuously running phases are established + User phase is running continuously, i.e. communication and interaction between user and provider, observation of user through provider + Provider phase is running continuously, i.e. data analytics, business model change and design	
	Interdependency	+ Preconditions ('ridepooling in city x' app, data analytics) for interdependency of user and provider phase are established + Dynamic consistency, i.e. internal and external fit, is the basis for business model change and design	- No automated start of business model change conceptualization, when user data were collected and analyzed (e.g. type of business model change is not determined by an algorithm) - Provider integration and push of individualized solution offerings into use processes is not feasible - The active signaling of real-time user data through users is not possible
	Simultaneousness	+ Preconditions ('ridepooling in city x' app, data analytics) for simultaneously running user and provider phase are established + User phase is running simultaneously to the provider phase and two different door2door units are working on the underlying process steps	
***User-centric*[893]**	***Enabling factors:***		
	Organizational integration	+ Internal integration: 'ridepooling in city x' app aligns user touch points into one overarching interface	- External integration: User assets (e.g. knowledge, creativity, feedback) are not exhaustively integrated into value network for user co-creation

[891] See chapters 6.3.3 and 6.3.4.
[892] See chapter 2.1 for constituting factors of dynamic approaches.
[893] See chapter 2.3 for enabling and constituting factors of user centricity.

		Matches and mismatches between BMC and unit of analysis		
Characteristics of a dynamic and user-centric business model approach		**Matches**		**Mismatches**
Data integration	+	Preconditions ('ridepooling in city x' app, data analytics) for data integration are established	-	Diverse external data (other than user data) are processed and analyzed through data analytics
	+	User data are collected through 'ridepooling in city x' app	-	The active signaling of real-time user data through users is not possible
	+	User data are processed and analyzed through data analytics and simulation software 'Insights'	-	User data, in general, cannot be assigned to individual users
Constituting factors:				
Bidirectional communication and interaction process	+	Precondition ('ridepooling in city x' app) for bidirectional communication and interaction process is established	-	The active signaling of real-time user data through users is not possible
			-	Provider integration and push of individualized solution offerings into use processes is not feasible
Proactive customization	+	Preconditions ('ridepooling in city x' app, data analytics) for proactive customization are established	-	The active signaling of real-time user data by users through 'ridepooling in city x' app is not possible
	+	Users can signal user data by email (through link in 'ridepooling in city x' app)	-	User data, in general, cannot be assigned to individual users
	+	User survey findings are used in data analytics	-	Provider integration and push of individualized solution offerings into use processes is not feasible
User integration	+	User feedback can be sent by email (through link in 'ridepooling in city x' app) or is collected through user surveys	-	The active signaling of real-time user data by users through 'ridepooling in city x' app is not possible
			-	User data, in general, cannot be assigned to individual users
			-	User assets (e.g. knowledge, creativity, feedback) are not exhaustively integrated into value network for user co-creation

Table 21: Matches and mismatches between design and change process of BMC and the 'ridepooling in city x' business model.

The first case study research question was: How is dynamic, user-centric business model design and change implemented into the unit of analysis? Design and change of the 'ridepooling in city x' business model were dynamic and user-centric, based on the matches presented in Table 21. However, to what degree is the 'ridepooling in city x' business model design and change process dynamic and user-centric? To answer this question, the mismatches between the theoretical model and the real-life case study have to be examined more closely. The discrepancies can be divided into three categories: interdependency issues (dynamic), missing implementation of behavioral customer model (user-centric), and use of external data other than user data. The first two categories point to mechanisms that were not implemented into the ‘ridepooling in city x’ business model design and change processes. The third category implies an indicator of change that is not used in the BMC model.

The unit of analysis implemented the essential preconditions (‘ridepooling in city x’ app, data analytics) to enable interdependency between the user and the provider phase. However, business model change conceptualization was not automatically initiated after data were collected, processed, and analyzed. The algorithms used by door2door can detect patterns or irregularities that might indicate a necessary business model change, but the algorithm does not automatically determine which type of change is needed. door2door employees are responsible for this. In conclusion, the interdependency between user phase (data collection) and provider phase (data analytics, business model change and design) is established but not automated.

The second category describes activities derived from the behavioral customer model presented in chapters 3.3.1.4 and 5.3.4.1. This involves no real-time signaling of profile data through users, and only anonymous data. Consequently, users cannot actively implement their assets into the value network, so value co-creation is only possible to a limited extent (except through user feedback by email, or user survey findings). Furthermore, the provider cannot target individual users and push customized solution offerings into their use processes.

The third category reveals an additional indicator of change: external data (e.g. anonymous location data from mobile network operators). These data are used to change and design the ‘ridepooling in city x’ business model.

In summary, design and change of the ‘ridepooling in city x’ business model were dynamic and user-centric. The basic technical requirements for implementing the behavioral customer model are given. Whether and to what extent door2door will fully implement these functions later on is beyond the scope of this dissertation.

Logic of linking the data to the proposition	**Criteria for interpreting the findings**	**Business model innovation***	**Business model adaptation****	**Business model evolution****
Crucial activities of dynamic, user-centric business model design and change process	*Listing of activities that are within the scope of the BMC*	Real-time data analytics of usage data	• Collection, processing, and analysis of profile and real-time usage data • Implementation of internal factors into business model design	• Collection, processing, and analysis of real-time usage data • Implementation of internal factors into business model design

Logic of linking the data to the proposition	**Criteria for interpreting the findings**	**Business model innovation***	**Business model adaptation****	**Business model evolution****
Competitive advantage developed/sustained through business model design and change?	*Examination if dynamic consistency can be reached, and/or the business model (especially all the assets) is not terminated, and/or the business is not liquidated*	door2door business model and herewith all assets were not terminated nor was the business liquidated	No conclusions can be drawn due to missing data	Dynamic consistency, i.e. fit between external factors (user needs) and internal resources (business model design) was reached
Rival explanation for competitive advantage	*Listing of steps within the business model design and change process that are out of the BMC scope*	Industry and competitor analysis	Collection, processing, and analysis of additional external data other than user data	-

* door2door 'software as a service' (SaaS) business model

** door2door 'ridepooling in city x' business model

Table 22: Findings of the case study linked to the case study proposition.

The second case study research question was: Why is dynamic, user-centric business model design and change crucial to developing and sustaining a competitive advantage? The causal chain developed in chapter 6.1.2 states dynamic consistency gives a competitive advantage if assets are not terminated, and/or the business is not liquidated. door2door's business model innovation, adaptation, and evolution between 2016 and 2019 involved several activities. These included activities that fall into the scope of the BMC, i.e. crucial steps for dynamic, user-centric business model design and change. These activities are listed in Table 22. For business model innovation and evolution, dynamic, user-centric design and change create a competitive advantage. This could not be determined in terms of business model adaptations because the business model designs were not implemented yet. Taken together, these findings confirm the case study proposition. However, possible rival explanations for the competitive advantage were found. These rival explanations arose from business model design and change activities that are beyond the BMC scope. These relevant activities (Table 22) should be considered in future investigations.

7 Sustaining a competitive advantage through dynamic, user-centric business model design and change in a digitalized era

Ever-changing business environments, the rise of customer power, and fast-moving digitalization pose a threat to static business models. Business models are in a constant state of disequilibrium between external environments and internal resources. To sustain a competitive advantage over time, managers must achieve dynamic consistency between the core elements so that the business model's configurational fit – and thus its effectiveness and performance – is in line with external dynamics.[894] Findings in this dissertation have shown that a dynamic, user-centric process model for business model design and change can help to meet these challenges and guide practitioners in business model management.

The following chapter summarizes the findings of this dissertation, the implications for science and management practice, and future research.

7.1 Dissertation findings

A significant contribution of this dissertation is a process model for dynamic, user-centric business model design and change: *The business model cycle (BMC).* Reports and statistics on markets, digital technologies and enterprises, and the management and marketing literature revealed a theoretical and practical *relevance for dynamic, user-centric business model processes*.[895] The case study research in the mobility sector suggested the model's *relevance to practical application*.[896]

This research also highlighted the relevance of being *dynamic* and *user-centric* in business model theory. 'Dynamic' was examined linguistically in relation to systems and processes. This involved a linguistic analysis of key terms, and a review of system dynamics logic. *Dynamic approaches* that involve processes and phases were defined as continuous, interdependent, and simultaneous. 'User-centric' was found to mean *user-centric approaches* according to the marketing concept of user centricity. These are en-

[894] Refer to Demil and Lecocq 2010, 241–242.
[895] See chapter 1.1 for the relevance of dynamic, user-centric business model design and change.
[896] See chapter 6 for the case study research.

abled by integrating data and users into organizational structures, allowing bidirectional communication between user and provider, proactive customization of products and services, and the integration of users and their assets to co-create value.[897]

An integral finding was that the triadic approach of business model dynamics, solution, and network theory changes business model perspectives from a static to a dynamic view, from an internal to a user-centric orientation, and from a linear value adding to networked value creation. Reviewing the management and marketing literature of business model, solution, and network theory increased the understanding of static, dynamic, and user-centric business model concepts. A *business model configuration* was defined as including value proposition, creation, distribution, and development. And three *types of business model change* were revealed: evolution, adaptation, and innovation. This described the static perspective of business models.[898]

To develop a dynamic perspective, *business model dynamics* were examined and defined as a process of continuous business model design and change in response to changing external and internal factors. Combining this finding with the fit approach of strategic management and the theory of dynamic capabilities unveiled the competitive advantage of dynamic business model environments. Business models with an external and internal fit have *dynamic consistency* between their core elements, i.e. the business model's internal configurational fit[899] is in line with its external dynamics. A dynamic, user-centric process for business model design and change was defined as a dynamic capability that sustains dynamic consistency and a competitive advantage. The investigation of *dynamics in business model design and change* specified the process of change (observation, analysis, and conceptualization) and design (ideation, prototyping, and integration).[900]

The user-centric perspective of business models had major overlaps with business model solution and network theory. User-centric value proposition is based on solutions and related concepts[901] while user-centric value creation and distribution are character-

[897] See chapters 2.1 and 2.3 for the characteristics of dynamic, user-centric approaches.

[898] See chapter 3.1 for the static perspective of business models.

[899] Configurational fit points towards the alignment of business model components and underlying elements which fosters the model's harmony and synergy and therewith its performance and effectiveness. Refer to Magretta 2002, 6; Nenonen and Storbacka 2010, 51–52; Kindström and Kowalkowski 2015, 10. See also chapter 3.2.4.4, Figure 14 in particular.

[900] See chapter 3.2 for the dynamic perspective of business models.

[901] See chapter 3.3.1 for related concepts, such as user-centric, mixed-criteria segmentation.

ized by value networks in which the user is both a beneficiary and a co-creator of value. Business model value development was linked to the behavioral customer model, where user and provider can communicate and interact bidirectionally using digital smart technologies.[902]

These findings developed the BMC further into three levels of abstraction and granularity: meta-model, sub-model, and modeled instance. All three models are dynamic and user-centric, and their configuration is based on systems dynamic logic. The *BMC meta-model* is a universal process model that can be applied to all real-world business models for dynamic, user-centric design and change. It was configured using dynamic, user-centric approaches and system dynamics logic to outline universally applicable phases (user, provider), components (user, business model), and input/output streams (information feedback, decision). The *BMC sub-model* is a specific process model that can be applied to digitalized business models[903] for dynamic, user-centric design and change. It is based on the BMC meta-model configuration and refers to business model theory, solution marketing, and network theory. The sub-model includes a user-sided component (point of use) and three pre-defined core business model components (value proposition, value creation and distribution, and value development) with underlying procedural steps and specified input/output streams. The *modeled instance of the BMC* is an operative business process for digitalized business models. Combining the BMC sub-model configuration with the BPMN modeling technique was the basis for the modeled instance design. In contrast to process models, the business process diagram does not depict components but includes detailed activities and input/output streams between activities. The BMC models support practitioners in strategic management or marketing to better understand and apply universal mechanisms, abstract procedural steps, and specific process activities to achieve dynamic, user-centric business model design and change. The model presents the mechanisms of bidirectional communication and interaction between user and provider as well as continuous user monitoring (observation step in business model change). It also describes simultaneous and inter-

[902] See chapter 3.3 for the user-centric perspective of business models.

[903] Within this dissertation, *digitalized business models* are understood as business models that incorporate technical facilities for a digital and interdependent communication and interaction between user and provider. Solutions that are marketed within these types of business models can still include physical products (e.g. car for sale at the car dealer), non-physical services (e.g. repairing a car at a workshop) as well as digital services (e.g. providing car software download for autonomous driving).

dependent business model design (ideation, prototyping, integration) and change (analysis, conceptualization).[904]

The issue emerging from these findings was the practical relevance of the BMC. The case study revealed that business model design and change processes match the BMC in many instances and give a competitive advantage. In the case study, all three BMC models were applied to a real-life business model – a German mobility solution provider. The objective was to discover matches and mismatches between the business model design and change processes of the theoretical BMC and the case study. This showed that the case study business model was designed and changed in a dynamic and user-centric way, and that this gave a sustainable competitive advantage. It also showed that external factors other than the user can affect business model design and change. The automated, algorithm-driven process of business model change that is implemented in the BMC logic does not fully apply to the case study. Data analytics detect possible changes in external factors (indicators of change) that might lead to business model change, but this process is not automated, i.e. the algorithm does not decide which type of business model change is needed. Data analytics are invaluable for decision-making, but business model changes are still decided by people.[905]

7.2 Implications for science and management practice

To fulfill the requirements of basic and applied research, the findings of this dissertation had to advance knowledge in business sciences and be relevant for real-world application.

Figure 66 shows how the presented findings advance the current knowledge and how they are relevant to real-world applications.

[904] See chapter 5 for the BMC.
[905] See chapter 6 for the case study research.

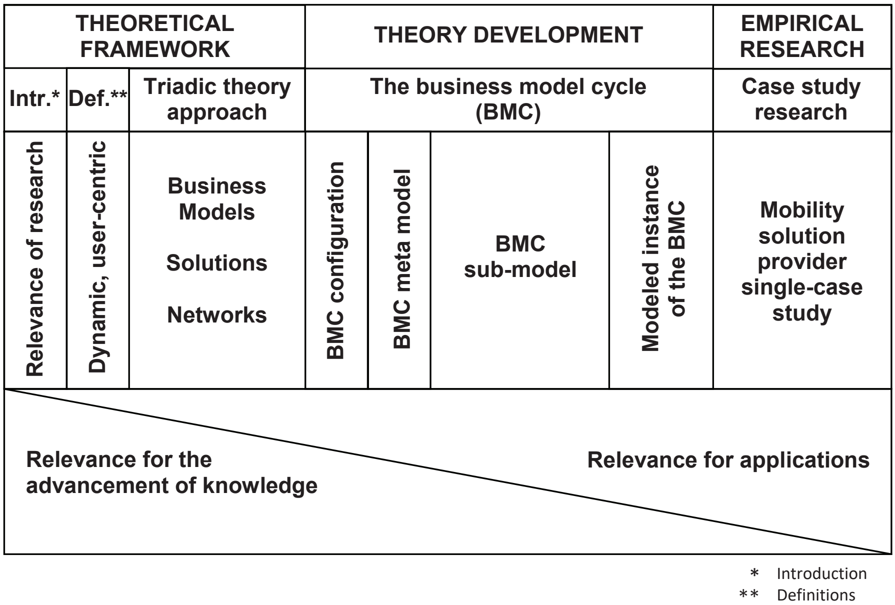

Figure 66: Research implications: advancements of knowledge and relevance for applications. Adapted from Stokes 1997, 73.

The **theoretical framework** of the dissertation advances knowledge by defining, discussing, evaluating, and combining theories and concepts. The *relevance of dynamic, user-centric business model design* and change in fast-changing business environments of the digital era presented here serves as a platform for future research.[906] Further research gaps and problem-solving approaches can build on this analysis; indeed, the need to advance knowledge in business sciences is high. The *characteristics of a dynamic, user-centric approach* can be applied to any scientific context concerned with systems and processes. The *triadic theory approach* builds the dissertation's theoretical foundation. Business model, solution marketing, and network theory are combined to broaden the static, dynamic, and user-centric aspects of business models. Several specific research gaps have been identified (e.g. in business model dynamics). Moreover, definitions, attributes, concepts, mechanisms, processes, and underlying activities in the field of static, dynamic, and user-centric business models have been discussed and applied to the research objectives. A *business model configuration* was adapted to dynamic and user-centric specifications. Value development (one of the configuration's

906 See chapter 1.1.

components) determines the indicators of business model change and the value transition process needed to stay abreast of changes in value. Value development has not been well investigated as a component of business models, so the business model configuration presented here advances the knowledge of this field.[907]

The derived definition of *business model dynamics* can be applied to future research.[908] Fundamental strategic management theories (fit approach, dynamic capabilities) were combined to define competitive advantage in dynamic business model environments. *Dynamic consistency* between the business model's core elements gives a competitive advantage. It is reached when the business model's internal configurational fit (internal fit) is in line with the external dynamics (external fit). The business model is in constant disequilibrium, and ever-recurring design and change activities adjust the balance.[909] This is relevant to advancing knowledge and creating strategies and actions in dynamic business model environments. The literature review on theoretical business model *design and change activities* revealed universal design and change processes and their underlying process steps.[910] A *dynamic business model design and change framework* was derived to clarify the meanings of internal fit, external fit, and dynamic consistency. For this purpose, the framework depicts the interdependencies of external factors, business model change, business model design, and internal factors.[911] These findings are relevant to advancing knowledge, especially in the field of business model dynamics.

A connection between *user-centric solutions* and business models was established. User-centric, mixed-criteria segmentation and integrated solution offerings were used to design value propositions, and the behavioral customer model was applied to deliver change through value development.[912] *User-centric value networks* were integrated into business model theory by linking them to value creation and distribution.[913] These findings advance the knowledge of networked solution business models and provide several points of contact with applications in digitalized business environments.

Theory development combines the theoretical framework with a new theoretical concept: the business model cycle (BMC). The fundamental *configuration of the BMC* pro-

[907] See chapter 3.1.2 for the business model configuration.
[908] See chapter 3.2.1.1 for the business model dynamics definition.
[909] See chapter 3.2.3 for dynamic consistency.
[910] See chapters 3.2.4.2 and 3.2.4.3 for business model change and design activities.
[911] See chapter 3.2.4.4 for a dynamic business model design and change framework.
[912] See chapter 3.3.1 for solutions.
[913] See chapter 3.3.2 for networks.

cess model is based on systems dynamic logic. The BMC was considered a network and analyzed mathematically using graph theory. The equations showed that the BMC can be expanded (number of phases) and that its density is scalable, according to the number of interdependent phases. These findings advance the current knowledge since the BMC configuration can be applied to every dynamic system or process.

The *BMC meta-model* can be applied to all industries and business models, but the *BMC sub-model* is specific to digitalized business models. Both showcase the mechanisms, phases, activity-based components, and input/output streams between components of dynamic, user-centric business model design and change. The sub-model also presents abstract process steps to conduct dynamic, user-centric business model design (ideation, prototyping, integration) and business model change (observation, analysis, conceptualization). The *modeled instance of the BMC* describes a detailed business process for dynamic, user-centric business model design and change. The business process diagram describes the activities and input/output streams between activities. The modeled instance refers to digitalized business models only. The BMC is relevant to knowledge advancement in business model theory because it is theoretically grounded and universally applicable (meta-model) to all digitalized business models (sub-model, modeled instance). The relevance to application can be attributed to the reference of the BMC sub-model and the modeled instance of the BMC to digitalized business models. The BMC can be used by new and well-established businesses since the continuum of change ranges from evolution to innovation. A start-up, for example, would start their dynamic, user-centric business model design and change with the innovation of a new business model.[914]

The **empirical research** was a longitudinal single-case study in the mobility sector. All three BMC models were applied to the business model design and change process of a mobility provider. Examining matches and mismatches between the BMC and the case study has revealed differences in theory and practice. By investigating a real-life case, valuable conclusions have been drawn about whether a dynamic, user-centric process for business model design and change can develop and sustain a competitive advantage. These findings are highly relevant to real-world businesses.[915]

[914] See chapter 5.1.4 for BMC hierarchy and classification.

[915] See chapter 6 for the case study research.

7.3 Conclusion and future research

This dissertation has advanced basic knowledge in science and is relevant and applicable to management practice. In the following, alternative research approaches and questions, other research contexts, additional or unanswered aspects, limitations of empirical research and future research are discussed. For this purpose, the research foundations introduced in the first chapter will be examined with reference to alternative aspects, theories, methodologies, technologies, and practical applications.[916]

Although it is relevant for business model design and change to be dynamic and user-centric, **alternative descriptive attributes** could have been applied to the process model. This is particularly true of the 'user-centric' attribute, as the case study showed that external factors other than users also impact business model change. The theoretical analysis showed that a variety of external factors in the micro and macro environment also affect the business model.[917] For example, legal, technological, or industry competitor factors could be defined and applied to the BMC. Since the BMC allows extension of phases, these operationalized factors could be connected to the value development component and analyzed through data analytics.

Although the theoretical foundation including business model, solution, and network theory was relevant to the research objectives and questions, **additional theories** may also be interesting. For example, the product service system (PSS) has many similarities to solution theory. It contains a set of products and/or services that unveil their full potential during use (value in use approach). But the PSS focuses more on sustainability, such as closing material cycles, dematerializing offerings, or increasing resource efficiency.[918] Combined with alternative attributes that define the process model's character, such as environmental factors, the PSS could be a suitable foundation for a sustainable process model for business model design and change.

Other approaches to empirical research could have been used. Case studies are often used in a business context because the demand for practical application is high.[919] To foster the replication logic and external validity of the case study, a multiple-case study design could be used in future research. Additionally, other evidence from the

[916] See chapter 1.3 or research foundations, Figure 3 in particular.
[917] See chapter 3.2.2 for external factors in the business model environment.
[918] Refer to Mont 2002, 237–239; Tukker 2004, 246–249; Pawar et al. 2009, 468–470.
[919] Refer to Yin 2003, 5–11.

same study (such as documents and archival records) could be examined to apply triangulation and increase construct validity.[920] Another methodological approach could be quantitative empirical research to, for example, measure changes in user satisfaction after applying the BMC to a real-life business model.

The technological foundation is subject to constant change. To maintain the relevance of application, **new technologies should be considered** when developing the BMC. Currently, blockchain technology is particularly interesting. Users can manage their individual profiles in the blockchain and determine exactly which data the provider should and should not have access to.[921] The use of smart technologies to analyze user behavior raises important ethical and privacy issues. This issue should be reviewed to address critical aspects of big data analytics, machine learning, IoT, and AmI and to assess precautions for protecting individuals and their personal data.[922]

The mobility sector was chosen as the dissertation's practical foundation because it has a dynamic and converging market, changing user needs and mobility behavior, and ongoing digitalization of mobility provider business models. The BMC is applicable to all business models and industries (meta-model), or digitalized business models in general (sub-model, modeled instance). Therefore, the **application to other fast-evolving industries** could reveal further insights into the effectiveness of the theoretical model in developing and sustaining a competitive advantage in dynamic environments.

[920] See chapter 6.1.3 for the quality of research design.

[921] See for example Chen et al. 2019.

[922] On the topic of ethics and privacy issues in big data analytics, social technologies or IoT see for example Introne et al. 2012; Hasan et al. 2013; Terzi et al. 2015; Herschel and Miori 2017; Nersessian 2018; Shahraki and Haugen 2018.

Appendices

Concept	Definition	Author(s)
Business model evolution	"A fine tuning process involving voluntary and emergent changes in and between permanently linked core components"	Demil and Lecocq (2010: 239)
Business model renewal	*(No definition provided)*	Doz and Kosonen (2010)
Business model replication	*(No definition provided)*	Dunford, Palmer, and Beneviste (2010)
Business model learning	An established firm modifies its business model in the face of competition from a new business model	Teece (2010)
Business model erosion	The declining competitiveness of established business models	McGrath (2010)
Business model lifecycle	"A business model lifecycle involving periods of specification, refinement, adaptation, revision and reformulation. An initial period during which the model is fairly informal or implicit is followed by a process of trial-and-error, and a number of core decisions are made that delimit the directions in which the firm can evolve."	Morris, Schindehutte, and Allen (2005: 732–3)

Concept	Definition	Author(s)
Business model reconfiguration	"We use the term to capture the phenomenon by which managers reconfigure organizational resources (and acquire new ones) to change an existing business model. Thus the process of reconfiguration requires shifting, with different degrees of radicalism, from an existing model to a new one."	Massa and Tucci (2014: 11)
Business model innovation	"Business model innovation is the discovery of a fundamentally different business model in an existing business"	Markides (2006: 20)
	"Business model innovation is a reconfiguration of activities in the existing business model of a firm that is new to the product service market in which the firm competes"	Santos, Spector, and Van den Heyden (2009: 14)

Appendix 1: Types of business model change (literature review).
Saebi 2015, 148.

Introductory questions

1. What is the role you fulfil in your company?
2. What do you understand by the term 'big data' and 'data analytics'?

Business model

3. Please describe your current business model.

Interpretation of customer data

4. To what extent can customer data indicate a business model change?
5. Can big data analytics be a basis for the adaptation of business models?

Business model design and change process

6. Please describe your process of business model design and change.
7. Did you change your business model recently?

If expert answered 'yes' to question 7:

8. Why and how was your business model changed?

Automated business model change

9. Do you consider it feasible that, based on big data analytics, business models are adapted automatically and synchronously with the changing needs of the customers?

Appendix 2: 2016 expert interview questionnaire (expert: Maxim Nohroudi, translated from German).

Introductory question

1. What is the role you fulfil in your company?

Business model

2. Please describe your current business model.

Interpretation of user data

3. Which user data do you have access to?
4. How do you gather, process, and analyze user data?

Business model design and change process

5. Please describe your process of business model design and change.
6. Did you change your business model since 2016?

If expert answered 'yes' to question 6:

7. Why and how was your business model changed?

Automated business model change

8. Based on data analytics, do you change and design your business model automatically and synchronously with the changing needs of the user?

Appendix 3: 2019 expert interview questionnaire (expert: Maxim Nohroudi, translated from German).

Bibliography

Achtenhagen, L., L. Melin, and L. Naldi. 2013. Dynamics of business models - strategizing, critical capabilities and activities for sustained value creation. Long Range Planning 46 (6), 427–442.

Adel, A., and B. Abdullah. 2015. A Comparison Between Three SDLC Models Waterfall Model, Spiral Model, and Incremental/Iterative Model. IJCSI International Journal of Computer Science Issues 12 (1), 106–111.

Afuah, A., and C.L. Tucci. 2003. Internet Business Models and Strategies: Text and Cases. 2nd ed. New York [a.o.]: McGraw-Hill.

Agrawal, A., J. Gans, and A. Goldfarb. 2017. How AI Could Change Amazon: A Thought Experiment. Harvard Business Review. https://hbr.org/2017/10/how-ai-will-change-strategy-a-thought-experiment.

Ahlert, D., and J. Kawohl. 2008. Best Practices des Solution Sellings. Münster.

Ahlert, D., F. von Wangenheim, J. Kawohl, and M. Zimmer. 2008. The Concept of Solution Selling: Theoretical Considerations and Methods. Münster.

Ahlert, M., G. Blaich, and J. Spelsiek. 2006. Vernetzes Wissen. Organisationale, motivationale, kognitive und technologische Aspekte des Wissensmanagements in Unternehmensnetzwerken. Wiesbaden: GWV Fachverlage GmbH.

Allee, V. 2000. Reconfiguring the value network. Journal of Business Strategy 21 (4), 36–39.

Allee, V. 2008. Value network analysis and value conversion of tangible and intangible assets. Journal of Intellectual Capital 9 (1), 5–24.

Allee, V. 2009. Value-creating networks: organizational issues and challenges. The Learning Organization 16 (6), 427–442.

Allen, R. 2017. 15 Applications of Artificial Intelligence in Marketing | Smart Insights. Smart Insights. https://www.smartinsights.com/managing-digital-marketing/marketing-innovation/15-applications-artificial-intelligence-marketing/?lipi=urn%3Ali%3Apage%3Ad_flagship3_pulse_read%3BXbWxVQVHRfC%2B55E2XFToHg%3D%3D.

Amit, R., and C. Zott. 2001. Value creation in E-business. Strategic Management Journal 22 (6–7), 493–520.

Amit, R., and C. Zott. 2012. Creating Value Through Business Model Innovation. MIT Sloan Management Review 53 (3), 41–49.

Amit, R., and C. Zott. 2015. Business Model Design: A Dynamic Capability Perspective. In: The Oxford Handbook of Dynamic Capabilities (Online Version), edited by, David J. Teece and Sohvi Heaton, 265-280 (Online Version: 1–18). Oxford: Oxford University Press.

Anderson, J.C., H. Håkansson, and J. Johanson. 1994. Dyadic Business Relationships within a Business Network Context. Journal of Marketing 58 (4), 1–15.

Audi Business Innovation GmbH. 2019. Audi on demand. . https://www.uk.audiondemand.com/audi-mobility/audi-on-demand/uk_en.html.

Azar, A.T., and S. Vaidyanathan. 2018. Advances in System Optimization and Control. Hershey PA: IGI Global.

Azuma, R., Y. Baillot, R. Behringer, S. Feiner, S. Julier, and B. MacIntyre. 2001. Recent Advances in Augmented Reality. IEEE Computer Graphics and Applications 21 (6), 34–47.

Baden-Fuller, C., and M.S. Morgan. 2010. Business models as models. Long Range Planning 43 (2–3), 156–171.

Baines, T.S., H.W. Lightfoot, O. Benedettini, and J.M. Kay. 2009. The servitization of manufacturing: A review of literature and reflection on future challenges. Journal of Manufacturing Technology Management 20 (5), 547–567.

Balocco, R., A. Cavallo, A. Ghezzi, and J. Berbegal-Mirabent. 2019. Lean business models change process in digital entrepreneurship. Business Process Management Journal 25 (7), 1520–1542.

Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. Journal of Management 17 (1), 99–120.

Belz, C. 1997. Leistungssysteme. In: Leistungs- und Kundensysteme, edited by, Chrisitian Belz, 12–39. St. Gallen: Verl. Thexis.

Benkenstein, M. 2018. Hat sich das Marketing als Leitkonzept der Unternehmensführung wirklich überlebt? – Eine kritische Stellungnahme. In: Marketing Weiterdenken. Zukunftspfade für eine marktorientierte

Unternehmensführung, edited by, Manfred Bruhn and Manfred Kirchgeorg, 49–64. Wiesbaden: Springer Fachmedien Wiesbaden.

von Berg, S., and A. Graff. 2016. The multi-modal customer. Customer needs and preferences in a world of connected mobility. International Transportation 68 (1), 44–47.

von Berg, S., and M. Randelhoff. 2019. The role of shared fleets in multimodal mobility solutions: Service diversity, infrastructure, and customer preferences. In: Electric Vehicles in Shared Fleets – A Management Perspective. Manuscript submitted for publication.

Berinato, S. 2017. Inside Facebook's AI Workshop. Harvard Business Review Digital Articles. https://hbr.org/2017/07/inside-facebooks-ai-workshop.

von Bertalanffy, L. 1945. Zu einer allgemeinen Systemlehre (unpublished). Blätter für deutsche Philosophie 18 (3/4).

Bertalanffy, L. von. 1973. General system theory : foundations, development, applications. New York: Braziller.

BI Intelligence, and Business Insider. 2018. Global mobility services market size in 2018 and 2030 (in billion U.S. dollars). Ed. Statista. https://www.statista.com/statistics/1022044/global-mobility-services-market-size/.

Bieger, T., and S. Reinhold. 2011. Das wertbasierte Geschäftsmodell – Ein aktualisierter Strukturierungsansatz. In: Innovative Geschäftsmodelle. Konzeptionelle Grundlagen, Gestaltungsfelder und unternehmerische Praxis, edited by, Thomas Bieger, Dodo zu Knyphausen-Aufseß, and Christian Krys, 13–70. Berlin, Heidelberg: Springer Berlin Heidelberg.

Biggemann, S., C. Kowalkowski, J. Maley, and S. Brege. 2013. Development and implementation of customer solutions: A study of process dynamics andmarket shaping. Industrial Marketing Management 42 (7), 1083–1092.

Bock, C., and S.A. White. 2012. New Capabilities for Interaction Modeling in BPMN 2.0. In: BPMN 2.0 Handbook. Second Edition: Updated and Expanded. Methods, Concepts, Case Studies and Standards in Business Process Modeling Notation (BPMN), edited by, Layna Fischer, 31–53. 2nd ed. Lighthouse Point: Future Strategies Inc.

Borchardt, A., and S.E. Göthlich. 2009. Erkenntnisgewinnung durch Fallstudien. In: Methodik der empirischen Forschung, edited by, Sönke Albers, Daniel Klapper, Udo Konradt, Achim Walter, and Joachim Molf, 33–48. 3rd ed. Wiesbaden: Springer Fachmedien.

Botschen, G., E.M. Thelen, and R. Pieters. 1997. Using means-end structures for benefit segmentation. An application to services. European Journal of Marketing 33 (1/2), 38–58.

Bruhn, M. 2018. Marketing Weiterdenken in der marktorientierten Unternehmensführung – Entwicklungen und Zukunftsthemen der Marketingdisziplin. In: Marketing Weiterdenken, edited by, Manfred Bruhn and Manfred Kirchgeorg, 25–47. Wiesbaden: Springer Fachmedien Wiesbaden.

Brynjolfsson, E., and A. Mcafee. 2017. The Business of Artificial Intelligence: what it can and cannot do for your organization. Harvard Business Review Digital Articles. https://hbr.org/cover-story/2017/07/the-business-of-artificial-intelligence.

Bullinger, H.-J., and T. Meiren. 2001. Service Engineering – Entwicklung und Gestaltung von Dienstleistungen. In: Handbuch Dienstleistungsmanagement, edited by, Manfred Bruhn and Heribert Meffert, 149–175. 2nd ed. Wiesbaden: Gabler.

Bullinger, H.-J., and A.-W. Scheer. 2006. Service Engineering. Entwicklung und Gestaltung innovativer Dienstleistungen. Ed. Hans-Jörg Bullinger and August-Wilhelm Scheer. 2nd ed. Berlin/Heidelberg: Springer-Verlag.

Bundesministerium für Verkehr und digitale Infrastruktur. 2019. Modell- und kontextbasierte Mobilitätsinformation auf Smart Public Displays und Mobilgeräten im öffentlichen Verkehr – SmartMMI. . https://www.bmvi.de/SharedDocs/DE/Artikel/DG/mfund-projekte/mobilitaetsinformationen-auf-smart-public-displays-smartmmi.html.

Bureau of Labor Statistics. 2019. Quarterly number of business starts in the United States from Q1 2010 to Q1 2019 (in 1,000s). Ed. Statista. https://www.statista.com/statistics/771207/quarterly-business-starts-us/.

Burianek, F., C. Ihl, S. Bonnemeier, and R. Reichwald. 2007. Typologisierung hybrider Produkte. Ein Ansatz basierend auf der Komplexität der Leistungserbringung. München.

Casadesus-Masanell, R., and J.E. Ricart. 2010. From Strategy to Business Models and onto Tactics. Long Range Planning 43 (2–3), 195–215.

Cavalcante, S., P. Kesting, and J. Ulhøi. 2011. Business model dynamics and innovation: (re)establishing the missing linkages. Management Decision 49 (8), 1327–1342.

Chen, Y., H. Xie, K. Lv, S. Wei, and C. Hu. 2019. DEPLEST: A blockchain-based privacy-preserving distributed database toward user behaviors in social networks. Information Sciences 501, 100–117.

Chesbrough, H. 2010. Business Model Innovation: Opportunities and Barriers. Long Range Planning 43 (2–3), 354–363.

Chesbrough, H., and R.S. Rosenbloom. 2002. The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spinoff Companies. Industrial and Corporate Change 11 (3), 529–555.

Chong, D., and H. Shi. 2015. Big data analytics: a literature review. Journal of Management Analytics 2 (3), 175–201.

Cisco Systems. 2018. Global mobile data traffic from 2017 to 2022 (in exabytes per month). Cisco Visual Networking Index 2018. Ed. Statista. https://www.statista.com/statistics/271405/global-mobile-data-traffic-forecast/.

Cosenz, F., and G. Noto. 2018. A dynamic business modelling approach to design and experiment new business venture strategies. Long Range Planning 51 (1), 127–140.

Daecke, J., and D. zu Knyphausen-Aufseß. 2011. Von der Kommunikation zur Kundenintegration: Neue Ansätze der Gestaltung der Beziehung zwischen Unternehmen und Kunden am Beispiel der Produktentwicklung. In: Innovative Geschäftsmodelle. Konzeptionelle Grundlagen, Gestaltungsfelder und unternehmerische Praxis, edited by, Thomas Bieger, Dodo zu Knyphausen-Aufseß, and Christian Krys, 143–162. Berlin, Heidelberg: Springer Berlin Heidelberg.

Dahlman, C.J. 1979. The Problem of Externality. The Journal of Law & Economics 22 (1), 141–162.

Datrium. 2019. Key drivers of IT transformation in organizations worldwide as of 2019. Ed. Statista. https://www.statista.com/statistics/1010724/worldwide-it-transformation-drivers/.

Davies, A. 2004. Moving base into high-value integrated solutions: a value stream approach. Industrial and Corporate Change 13 (5), 727–756.

Davies, A., T. Brady, and M. Hobday. 2006. Charting a path toward integrated solutions. MIT Sloan Management Review 47 (3), 39–48.

Davies, A., P. Tang, M. Hobday, T. Brady, H. Rush, and D. Gann. 2001. Integrated solutions: The new economy between manufacturing and services. Falmer: SPRU (Science & Technology Policy Research).

Demil, B., and X. Lecocq. 2010. Business Model Evolution: In Search of Dynamic Consistency. Long Range Planning 43 (2–3), 227–246.

Donovan, A. 2000. Intermodal Transportation in Historical Perspective. Transportation Law Journal 27 (3), 317–344.

Douglas, D.A., M.A. Covington, M.M. Covington, and C.A. Covington. 2009. Dictionary of Computer and Internet Terms. 10th ed. Hauppauge, N.Y: Barron's.

Durand, A., and L. Harms. 2018. Mobility-as-a-Service and changes in travel preferences and travel behaviour : a systematic literature review. KiM Netherlands Institute for Transport Policy Analysis.

Dyer, J.H., and H. Singh. 1998. The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. The Academy of Management Review 23 (4), 660–679.

Eisenhardt, K.M., and J.A. Martin. 2000. Dynamic Capabilties: What are they?. Strategic Management Journal 1121 (21), 1105–1121.

Engelhardt, W. 1966. Grundprobleme der Leistungslehre, dargestellt am Beispiel der Warenhandelsbetriebe. In Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung 18 (2), 158–178.

Eschenbächer, J., K.-D. Thoben, A. Hesmer, and M. Herter. 2011. Using the Extended Product Concept to better Understand New Business Models along Product Life Cycles : The Case of E-Mobility. In: PLM11 8th International Conference on Product Lifecycle Management, 297–308.

Eskofier, B., S. Lee, M. Baron, A. Simon, C. Martindale, H. Gaßner, and J. Klucken. 2017. An Overview of Smart Shoes in the Internet of Health Things: Gait and Mobility Assessment in Health Promotion and Disease Monitoring. Applied Sciences 7 (986), 1–17.

Evanschitzky, H., F. V. Wangenheim, and D.M. Woisetschläger. 2011. Service & solution innovation: Overview and research agenda. Industrial Marketing Management 40 (5), 657–660.

Fader, P. 2012. Customer Centricity. Focus on the Right Customers for Strategic Advantage. 2nd ed. Philadelphia: Wharton Digital Press.

Faggela, D. 2017. The future of AI marketing applications in retail. Martech: Commerce. https://martechtoday.com/future-ai-marketing-applications-retail-202081.

Ferreira, F.N.H., J.F. Proença, R. Spencer, and B. Cova. 2013. The transition from products to solutions: External business model fit and dynamics. Industrial Marketing Management 42 (7), 1093–1101.

Foote, N.W., J. Galbraith, Q. Hope, and D. Miller. 2001. Making solutions the answer. The McKinsey Quarterly (3), 84–93.

Forbes, and MicroStrategy. 2019. Technologies that will have the greatest impact on analytics over the next five years worldwide in 2018 and 2019. Ed. Statista. https://www.statista.com/statistics/893831/worldwide-analytics-impactful-technologies/.

Forkmann, S., C. Ramos, S.C. Henneberg, and P. Naudé. 2017. Understanding the service infusion process as a business model reconfiguration. Industrial Marketing Management 60, 151–166.

Forrester, J.W. 1961. Industrial Dynamics. New York: Massachusetts Inst. of Technology.

Frankenberger, K., T. Weiblen, M. Csik, and O. Gassmann. 2013a. The 4I-framework of business model innovation: a structured view on process phases and challenges. International Journal of Product Development 18 (3/4), 249–273.

Frankenberger, K., T. Weiblen, and O. Gassmann. 2013b. Network configuration, customer centricity, and performance of open business models: A solution provider perspective. Industrial Marketing Management 42 (5), 671–682.

Gadatsch, A. 2017. Grundkurs Geschäftsprozess-Management. Analyse, Modellierung, Optimierung und Controlling von Prozessen. 8th ed. Wiesbaden: Springer Fachmedien Wiesbaden.

Galbraith, J.R. 2002. Organizing to deliver solutions. Organizational Dynamics 31 (2), 194–207.

Gandomi, A., and M. Haider. 2015. Beyond the hype: Big data concepts, methods, and analytics. International Journal of Information Management 35 (2), 137–144.

Gassmann, O., K. Frankenberger, and M. Csik. 2017a. Geschäftsmodelle entwickeln. 2nd ed. München: Carl Hanser Verlag GmbH & Co. KG.

Gassmann, O., K. Frankenberger, and M. Csik. 2017b. Das Prinzip des Business Model Navigators. In: Geschäftsmodelle entwickeln, edited by, Oliver Gassmann, Karolin Frankenberger, and Michaela Csik, 21–69. 2nd ed. München: Carl Hanser Verlag GmbH & Co. KG.

Gerdes, J. 2018. Kundenorientierung durch augmentiertes Marketing. In: Marketing Weiterdenken. Zukunftspfade für eine marktorientierte Unternehmensführung, edited by, Manfred Bruhn and Manfred Kirchgeorg, 187–199. Wiesbaden: Springer Fachmedien Wiesbaden.

Ghasemaghaei, M., S. Ebrahimi, and K. Hassanein. 2018. Data analytics competency for improving firm decision making performance. Journal of Strategic Information Systems 27 (1), 101–113.

Gomes-Casseres, B. 2003. Competing in Alliance Constellations : A Primer for Managers. Strategic Organization 1 (3), 327–335.

Gössling, S. 2017. ICT and transport behaviour: a conceptual review. International Journal of Sustainable Transportation 12 (3), 153-164 (ResearchGate 1–22).

Grandinetti, L. 2015. Big Data and High Performance Computing. Advances in Parallel Computing. Amsterdam, Netherlands: IOS Press.

Grover, P., and A.K. Kar. 2017. Big Data Analytics: A Review on Theoretical Contributions and Tools Used in Literature. Global Journal of Flexible Systems Management 18 (3), 203–229.

Gruber, T.R. 1993. A Translation Approach to Portable Ontology Specifications. Knowledge Acquisition 5 (2), 199–220.

Günther, W.A., M.H. Rezazade Mehrizi, M. Huysman, and F. Feldberg. 2017. Debating big data: A literature review on realizing value from big data. Journal of Strategic Information Systems 26 (3), 191–209.

Gutman, J. 1981. A Means-End model for facilitating analyses of product markets based on customer judgement. Advances in Consumer Research 8 (1), 116–121.

Gutman, J. 1982. A means-end chain model based on consumer categorization processes. The Journal of Marketing 46 (2), 60–72.

Hakanen, T., and E. Jaakkola. 2012. Co-creating customer-focused solutions within business networks: a service perspective. Journal of Service Management 23 (4), 593–611.

Haley, R.I. 1961. Experimental Research on Attitudes Toward Shampoos (unpublished paper).

Haley, R.I. 1968. Benefit Segmentation: A Decision-Oriented Research Tool. Journal of Marketing 32 (3), 30–35.

Haley, R.I. 1984. Benefit Segmentation –20 Years Later. Journal of Consumer Marketing 1 (2), 5–13.

Haley, R.I. 1995. Benefit Segmentation: A Decision-Oriented Research Tool. Marketing Management 4 (1), 59–62.

Hamel, G. 2001. Leading the revolution. Strategy & Leadership 29 (1), 4–10.

HarperCollins Publishers. 2019. dynamic. Collins Online English Dictionary. https://www.collinsdictionary.com/dictionary/english/dynamic.

Hasan, O., B. Habegger, L. Brunie, N. Bennani, and E. Damiani. 2013. A Discussion of Privacy Challenges in User Profiling with Big Data Techniques: The EEXCESS Use Case. In: 2013 IEEE International Congress on Big Data, 25–30. IEEE.

Hax, A.C., and D.L. Wilde II. 1999. The Delta Model : Adaptive Management for a Changing World. Sloan Management Review 40 (2), 11–28.

Heikkilä, M., and S. Brax. 2009. Servitization within a services firm? The case of a payment solutions provider. Aalto University School of Science and Technology, BIT Research Centre.

Hennart, J.-F. 1993. Explaining the Swollen Middle : Why Most Transactions Are a Mix of "Market " and “Hierarchy.” Organization Science 4 (4), 529–547.

Hentschel, R., and C. Leyh. 2018. Cloud Computing: Status quo, aktuelle Entwicklungen und Herausforderungen. In: Cloud Computing - Die Infrastruktur der Digitalisierung, edited by, Stefan Reinheimer, 3–20. Wiesbaden: Springer Vieweg.

Herschel, R., and V.M. Miori. 2017. Ethics & Big Data. Technology in Society 49, 31–36.

Heußler, T. 2011. Zeitliche Entwicklung von Netzwerkbeziehungen. Theoretische Fundierung und empirische Analyse am Beispiel von Franchise-Netzwerken. Wiesbaden: Gabler Verlag.

Hienerth, C., P. Keinz, and C. Lettl. 2011. Exploring the nature and implementation process of user-centric business models. Long Range Planning 44 (5–6), 344–374.

Hilgert, T., M. Kagerbauer, T. Schuster, and C. Becker. 2016. Optimization of Individual Travel Behavior through Customized Mobility Services and their Effects on Travel Demand and Transportation Systems. Transportation Research Procedia 19 (June), 58–69.

Houghton Mifflin Harcourt Publishing Company. 2019. dy·nam·ic. The American Heritage Dictionary of the English Language. https://www.ahdictionary.com/word/search.html?q=dynamic.

IDC, and Statista estimates. 2019. Digital transformation market revenue worldwide from 2017 to 2019 and in 2022 and 2023 (in trillion U.S. dollars). Ed. IDC, Statista. https://www.statista.com/statistics/870924/worldwide-digital-transformation-market-size/.

Introne, J., K. Levy, S. Munson, S. Goggins, R. Wash, and C. Aragon. 2012. Design, influence, and social technologies. In: Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work Companion - CSCW '12. New York: ACM Press.

ITU. 2018. Percentage of global population accessing the internet from 2005 to 2018, by market maturity. Ed. Statista. https://www.statista.com/statistics/209096/share-of-internet-users-in-the-total-world-population-since-2006/.

Jaakkola, E., and T. Hakanen. 2013. Value co-creation in solution networks. Industrial Marketing Management 42 (1), 47–58.

Janssen, M., H. van der Voort, and A. Wahyudi. 2017. Factors influencing big data decision-making quality. Journal of Business Research 70, 338–345.

Juntunen, M. 2017. Business model change as a dynamic capability. Finland, Europe: Oulun yliopisto.

Kalka, R., and K. Abel. 2018. Customer Centricity: Konzeptionelle Grundlagen und Implementierung. Düsseldorf Working Papers in Applied Management and Economics (44).

Kasper, H., C. Dukino, and H. Kett. 2012. Marketing und Vertrieb für Cloud-Angebote. In: Neue Geschäftsmodelle für die Cloud entwickeln. Methoden, Modelle und Erfahrungen für “Software-as-a-Service” im Unternehmen, edited by, Dieter Spath, Nico Weiner, and Thomas Renner, 173–184.

Kawohl, J.M. 2010. Lösungsorientierung von Handelsunternehmen. Konzeption und Erfolgsmessung. Wiesbaden: Gabler Verlag.

Kindström, D. 2010. Towards a service-based business model – Key aspects for future competitive advantage. European Management Journal 28 (6), 479–490.

Kindström, D., and C. Kowalkowski. 2015. Service-driven Business Model Innovation. Organizing the Shift from a Product-based to a Service-centric Business Model. In: Business Model Innovation: The Organizational Dimension, edited by, Nicolai J Foss and Tina Saebi, 191–216. Oxford: Oxford University Press.

Kleinaltenkamp, M., T. Bach, and I. Griese. 2009. Der Kundenintegrationsbegriff im (Dienstleistungs-)Marketing. In: Kundenintegration, edited by, Manfred Bruhn and Bernd Strauss, 35–62. Wiesbaden: Gabler.

Klinger, T. 2017. Moving from monomodality to multimodality? Changes in mode choice of new residents. Transportation Research Part A: Policy and Practice 104, 221–237.

Kohne, A. 2019. Business Development. Kundenorientierte Geschäftsfeldentwicklung für erfolgreiche Unternehmen. 2nd ed. Wiesbaden: Springer Fachmedien Wiesbaden.

Kowalkowski, C. 2011. Dynamics of value propositions: insights from service-dominant logic. European Journal of Marketing 45 (1/2), 277–294.

Kromrey, H. 2006. Empirische Sozialforschung. Modelle und Methoden der standardisierten Datenerhebung und Datenauswertung. Stuttgart: Lucius & Lucius.

Krystek, U., and G. Müller-Stewens. 1990. Grundzüge einer Strategischen Frühaufklärung. In: Strategische Unternehmungsplanung - strategische Unternehmungsführung: Stand und Entwicklungstendenzen, edited by, D. Hahn, 337–365. 5th ed. Heidelberg: Physica-Verl.

Kuhnimhof, T., R. Buehler, M. Wirtz, and D. Kalinowska. 2012. Travel trends among young adults in Germany: increasing multimodality and declining car use for men. Journal of Transport Geography 24, 443–450.

Kujala, S., K. Artto, P. Aaltonen, and V. Turkulainen. 2010. Business models in project-based firms – Towards a typology of solution-specific business models. International Journal of Project Management 28 (2), 96–106.

Lai, C.T., P.R. Jackson, and W. Jiang. 2017. Shifting paradigm to service-dominant logic via Internet-of-Things with applications in the elevators industry. Journal of Management Analytics 4 (1), 35–54.

Lamberti, L. 2013. Customer centricity: the construct and the operational antecedents. Journal of Strategic Marketing 21 (7), 588–612.

Lay, G., M. Schroeter, and S. Biege. 2009. Service-based business concepts: A typology for business-to-business markets. European Management Journal 27 (6), 442–455.

Lee, D.B., L.A. Klein, and G. Camus. 1999. Induced Traffic and Induced Demand. Transportation Research Record 1659 (1), 68–78.

Leimeister, J.M. 2012. Dienstleistungsengineering und -management. Berlin, Heidelberg: Springer Berlin Heidelberg.

Levitt, T. 1980. Marketing success through differentiation - of anything. Harvard Business Review 58 (1), 83–92.

Levitt, T. 1983. The marketing imagination. New York: Free Press.

Levitt, T. 2004. Marketing Myopia (1960, republished in 2004). Harvard Business Review 82 (7/8), 138–149.

Lieberman, H., F. Paternò, M. Klann, and V. Wulf. 2006. End-User Development: An Emerging Paradigm. In: End User Development. Human-Computer Interaction Series, edited by, H. Liebermann, F. Paternò, and V. Wulf, 1–8. Dordrecht: Springer.

Liebl, F. 1996. Strategische Frühaufklärung. München [a.o.]: Oldenburg.

Linder, J.C., and S. Cantrell. 2000. Changing Business Models: Surveying the Landscape. Accenture Institute for Strategic Change.

Linder, J.C., and S. Cantrell. 2001. Five business-model myths that hold companies back. Strategy & Leadership 29 (6), 13–18.

Loebbecke, C., and A. Picot. 2015. Reflections on societal and business model transformation arising from digitization and big data analytics: A research agenda. Journal of Strategic Information Systems 24 (3), 149–157.

Lomas, N. 2014. Amazon Patents “Anticipatory” Shipping — To Start Sending Stuff Before You’ve Bought It. TechCrunch. https://techcrunch.com/2014/01/18/amazon-pre-ships/.

Lycett, M. 2013. “Datafication”: Making sense of (big) data in a complex world. European Journal of Information Systems 22 (4), 381–386.

Maani, K., and R.Y. Cavana. 2007. Systems Thinking, System Dynamics. Managing Change and Complexity. 2nd ed. Rosedale: Pearson Prentice Hall.

Magretta, J. 2002. Why Business Models Matter. In: Harvard Business Review. Reprint r0205f, 3–8. Brighton: Harvard Business School Publishing Corporation.

Mahadevan, B. 2000. Business Models for Internet-Based E-Commerce: An Anatomy. California Management Review 42 (4), 55–69.

Mathieu, V. 2001. Service strategies within the manufacturing sector: benefits, costs and partnership. International Journal of Service Industry Management 12 (5), 451–475.

Mathis, K., and F. Köbler. 2016. Data-Need Fit – Towards data-driven business model innovation. In: Procceednigs of Fifth Service Design and Innovation conference, 458–467.

Matyas, M., and M. Kamargianni. 2019. The potential of mobility as a service bundles as a mobility management tool. Transportation 46 (5), 1951–1968.

McGrath, R.G. 2010. Business Models: A Discovery Driven Approach. Long Range Planning 43 (2–3), 247–261.

McKinsey, Capital IQ, and PitchBook. 2019. Annual average worldwide investments in mobility start-ups between 2014 and February 2019, by technology cluster (in billion U.S. dollars). Ed. Statista. https://www.statista.com/statistics/1013576/global-investments-in-mobility-start-ups-by-technology/.

Meier, H., and E. Uhlmann. 2012. Hybride Leistungsbündel – ein neues Produktverständnis. In: Integrierte Industrielle Sach- und Dienstleistungen, edited by, Horst Meier and Eckart Uhlmann, 1–21. Berlin, Heidelberg: Springer Berlin Heidelberg.

Meier, H., E. Uhlmann, and D. Kortmann. 2005. Hybride Leistungsbündel: nutzenorientiertes Produktverständnis durch interferierende Sach- und Dienstleistungen. wt Werkstattstechnik online (7/8), 528–532.

Meier, H., O. Völker, and B. Funke. 2011. Industrial Product-Service Systems (IPS2). Paradigm shift by mutually determined products and services. The International Journal of Advanced Manufacturing Technology 52 (9–12), 1175–1191.

Merriam-Webster. 2019. Dynamic adjective. Merriam-Webster Dictionary. https://www.merriam-webster.com/dictionary/dynamic#h1.

Merrick, L. 2016. 4 Ways To Delight Customers With Artificial Intelligence In Mobile Apps. Medium. https://medium.com/@LoganTjm/4-ways-to-delight-customers-with-artificial-intelligence-in-mobile-apps-2f00d955c4e9.

Meyer de Freitas, L., H. Becker, M. Zimmermann, and K.W. Axhausen. 2019. Modelling intermodal travel in Switzerland: A recursive logit approach. Transportation Research Part A: Policy and Practice 119, 200–213.

Mezger, S.A. 2018. Entwicklung eines komponentenbasierten Vorgehensmodells zum Geschäftsmodell-Management am Beispiel der E-Carsharing-Branche. In: Schriftenreihe des Energie-Forschungszentrums Niedersachsen (EFZN), Band 52. Göttingen: Cuvillier.

Miller, D., Q. Hope, R. Eisenstat, N. Foote, and J. Galbraith. 2002. The problem of solutions: Balancing clients and capabilities. Business Horizons 45 (2), 3–12.

Mitchell, D., and C. Coles. 2003. The ultimate competitive advantage of continuing business model innovation. Journal of Business Strategy 24 (5), 15–21.

Mohammed, N., A. Munassar, and A. Govardhan. 2010. A Comparison Between Five Models Of Software Engineering. International Journal of Computer Science 7 (5), 94–101.

Mont, O. 2002. Clarifying the concept of product-service system. Journal of Cleaner Production 10 (3), 237–245.

Morecroft, J.D.W. 2015. Strategic Modelling and Systems Dynamics. A Feedback Systems Approach. 2nd ed. Chichester, West Sussex, United Kingdom: John Wiley and Sons Ltd.

Morris, M., M. Schindehutte, and J. Allen. 2005. The entrepreneur's business model: Toward a unified perspective. Journal of Business Research 58 (6), 726–735.

Nenonen, S., and K. Storbacka. 2010. Business model design: conceptualizing networked value co-creation. International Journal of Quality and Service Sciences 2, 43–59.

Nersessian, D. 2018. The law and ethics of big data analytics: A new role for international human rights in the search for global standards. Business Horizons 61 (6), 845–854.

Nest Labs. 2017a. Meet the Nest Learning Thermostat. . https://nest.com/thermostats/nest-learning-thermostat/overview/.

Nest Labs. 2017b. Learn more about Rush Hour Rewards. . https://nest.com/support/article/What-is-Rush-Hour-Rewards.

Nobis, C. 2007. Multimodality. Facets and causes of Sustainable Mobility Behavior. Transportation Research Record: Journal of the Transportation Research Board 2010 (1), 35–44.

Nobis, C. 2015. Multimodale Vielfalt. Quantitative Analyse multimodalen Verkehrshandelns. Mathematisch-Naturwissenschaftliche Fakultät II. Humboldt-Universität zu Berlin.

Nobis, C., and T. Kuhnimhof. 2018. Mobilität in Deutschland – MiD Ergebnisbericht. Studie von infas, DLR, IVT und infas 360 im Auftrag des Bundesministers für Verkehr und digitale Infrastruktur (FE-Nr. 70.904/15). Bonn, Berlin.

Nordin, F., and C. Kowalkowski. 2010. Solutions offerings: a critical review and reconceptualisation. Journal of Service Management 21 (4), 441–459.

Norman, R., and R. Ramirez. 1993. From Value Chain to Value Constellation: Designing Interactive Strategy. Harvard business review 71 (4), 65–77.

Object Management Group. 2011. Business Process Model and Notation (BPMN). Version 2.0. OMG Document Number: formal/2011-01-03. http://www.omg.org/spec/BPMN/2.0.

OECD. Economy-wide regulation. OECD Product Market Regulation Statistics. https://doi.org/10.1787/data-00593-en.

Osterwalder, A. 2004. The business model ontology. A proposition in a design science approach. Lausanne: University of Lausanne.

Osterwalder, A. 2010. Users vs Customers. Business Model Alchemist. http://businessmodelalchemist.com/blog/2010/07/users-vs-customers.html.

Osterwalder, A., and Y. Pigneur. 2010. Business Model Generation: A handbook for visionaries, game changers, and challengers. Hoboken: Wiley.

Osterwalder, A., Y. Pigneur, G. Bernarda, and A. Smith. 2014. Value Proposition Design: How to Create Products and Services Customers Want. Hoboken, NJ: John Wiley & Sons.

Osterwalder, A., Y. Pigneur, and C.L. Tucci. 2005. Clarifying Business Models: Origins, Present, and Future of the Concept. Communications of AIS 15, 1–40.

Oxford University Press. 2019a. dynamic. Lexico. https://www.lexico.com/en/definition/dynamic.

Oxford University Press. 2019b. dynamic, adj. and n. Oxford English Dictionary Online. https://www.oed.com/view/Entry/58818?rskey=6kw4Mf&result=1&isAdvanced=false#eid.

Oxford University Press. 2019c. constant, adj. and n. Oxford English Dictionary Online. https://www.oed.com/view/Entry/39807?redirectedFrom=constant#eid.

Oxford University Press. 2019d. change. Lexico. https://www.lexico.com/en/definition/change.

Oxford University Press. 2019e. activity. Lexico. https://www.lexico.com/en/definition/activity.

Oxford University Press. 2019f. progress. Lexico. https://www.lexico.com/en/definition/progress.

Page, D. 2014. Graphs and Graph Theory. In: Complex Networks: Principles, Methods and Applications, edited by, V. Latora, V. Nicosia, and G. Russo, 1–30. Cambridge: Cambridge University Press.

Palo, T., and J. Tähtinen. 2013. Networked business model development for emerging technology-based services. Industrial Marketing Management 42 (5), 773–782.

Pawar, K.S., A. Beltagui, and J.C.K.H. Riedel. 2009. The PSO triangle: designing product, service and organisation to create value. International Journal of Operations & Production Management 29 (5), 468–493.

Penttinen, E., and J. Palmer. 2007. Improving firm positioning through enhanced offerings and buyer–seller relationships. Industrial Marketing Management 36 (5), 552–564.

Peteraf, M.A. 1993. The Cornerstones of Competitive Advantage: A Resource Based View. Strategic Management Journal 14 (3), 179–191.

Petrovic, O., C. Kittl, and R.D. Teksten. 2001. Developing Business Models for eBusiness. In: International Conference on Electronic Commerce 2001, page numbers not provided. Vienna.

Pfau, W. 2001. Strategisches Management. In: Kompaktstudium Wirtschaftswissenschaften (Band 16). München: Vahlen.

Pinkwart, A. 2018. Change Management in Zeiten digitalen Wandels. In: Marketing Weiterdenken. Zukunftspfade für eine marktorientierte Unternehmensführung, edited by, Manfred Bruhn and Manfred Kirchgeorg, 349–363. Wiesbaden: Springer Fachmedien Wiesbaden.

Porter, M.E. 1980. Competitive strategy: Techniques for analyzing industries and competitors. New York: Free Press.

Porter, M.E. 1985. Competitive Advantage: Creating and sustaining superior performance. New York: Free Press.

Prause, J. 2016. Digitization vs. Digitalization – Wordplay or World View?. SAP News Center. https://news.sap.com/2016/05/digitization-vs-digitalization-wordplay-or-world-view/.

Priem, R.L., M. Wenzel, and J. Koch. 2018. Demand-side strategy and business models: Putting value creation for consumers center stage. Long Range Planning 51 (1), 22–31.

Procter & Gamble. 2019. Oral-B Genius 8000. Rechargeable Electric Toothbrush. https://oralb.com/en-us/products/electric-toothbrushes/genius-8000-rechargeable-electric-toothbrush/.

Putten, B. Van, M. Schief, H. Berlin, and T.U. Darmstadt. 2012. The Relationship Between Dynamic Business Models and Business Cases. The Electronic Journal Information Systems Evaluation 15 (1), 138–148.

Ragunath, P., S. Velmourougan, P. Davachelvan, S. Kayalvizhi, and R. Ravimohan. 2010. Evolving A New Model (SDLC Model-2010) For Software Development Life Cycle (SDLC). International Journal of Computer Science and Network Security 10 (1), 112–119.

Reichardt, T. 2008. Bedürfnisorientierte Marktstrukturanalyse für technische Innovationen. Eine empirische Untersuchung am Beispiel Mobile Commerce. 1st ed. Wiesbaden: Betriebswirtschaftlicher Verlag Dr. Th.Gabler.

Reinartz, W. 2018. Kundenansprache in Zeiten digitaler Transformation. In: Marketing Weiterdenken. Zukunftspfade für eine marktorientierte Unternehmensführung, edited by, Manfred Bruhn and Manfred Kirchgeorg, 123–127. Wiesbaden: Springer Fachmedien Wiesbaden.

de Reuver, M., H. Bouwman, and I. Macinnes. 2009. Business model dynamics : a case survey. Journal of Theoretical and Applied Electronic Commerce Research 4 (1), 1–11.

Reynolds, T., and J. Gutman. 1984. Laddering: extending the repertory grid methodology to construct attribute-consequence-value hierarchies. In: Personal values and consumer psychology, edited by, R. E. Pitts and A. G. Woodside, 155–167. Lexington: Lexington Books.

Reynolds, T., and J. Gutman. 1988. Laddering theory, method, analysis, and interpretation. Journal of Advertising Research 28 (1), 11–31.

Ricart, J.E., and R. Casadesus-Masanell. 2011. How to Design A Winning Business Model. Harvard Business Review (January-February).

Richardson, G.P. 1991. Feedback thought in social science and systems theory. Philadelphia: Univ. of Pennsylvania Press.

Richardson, G.P. 2009. System Dynamics, The Basic Elements of. In: Encyclopedia of Complexity and Systems Science, edited by, Robert A. Meyers, 8967–8974. New York: Springer New York.

Richter, H.M., and M. Tschandl. 2017. Service Engineering ? Neue Services erfolgreich gestalten und umsetzen. In: Dienstleistungen 4.0, edited by, Manfred Bruhn and Karsten Hadwich, 157–184. Wiesbaden: Springer Fachmedien Wiesbaden.

Ruparelia, N.B. 2010. Software development lifecycle models. ACM SIGSOFT Software Engineering Notes 35 (3), 8–13.

Russel, S.J., and P. Norvig. 2016. Artificial intelligence : a modern approach. 3rd ed. Boston: Pearson.

Saccani, N., F. Visintin, and M. Rapaccini. 2014. Investigating the linkages between service types and supplier relationships in servitized environments. International Journal of Production Economics 149, 226–238.

Saebi, T. 2015. Evolution, Adaptation, or Innovation? A Contingency Framework on Business Model Dynamics. In: Business Model Innovation: The Organizational Dimension, edited by, Nicolai J Foss and Tina Saebi, 145–168. Oxford: Oxford University Press.

Saebi, T., L. Lien, and N.J. Foss. 2017. What Drives Business Model Adaptation? The Impact of Opportunities, Threats and Strategic Orientation. Long Range Planning 50 (5), 567–581.

Saggi, M.K., and S. Jain. 2018. A survey towards an integration of big data analytics to big insights for value-creation. Information Processing and Management 54 (5), 758–790.

Santos, J., B. Spector, and L. Van der Heyden. 2015. Toward a Theory of Business Model Change. In: Business Model Innovation: The Organizational Dimension, edited by, Nicolai J. Foss and Tina Saebi, 43–63. Oxford: Oxford University Press.

Santos, M.Y., B. Martinho, and C. Costa. 2017. Modelling and implementing big data warehouses for decision support. Journal of Management Analytics 4 (2), 111–129.

Sawhney, M. 2006. Going beyond the product, defining, designing and delivering customer solutions. In: The Service-dominant Logic of Marketing: Dialog, Debate, and Directions, edited by, Robert F. Lusch and Stephen L. Vargo, 365-380 (ResearchGate 1–33). M.E. Sharpe.

Schallmo, D. 2013a. Geschäftsmodell-Innovation. Grundlagen, bestehende Ansätze, methodisches Vorgehen und B2B-Geschäftsmodelle. Wiesbaden: Springer Fachmedien Wiesbaden.

Schallmo, D. 2013b. Geschäftsmodelle erfolgreich entwickeln und implementieren. Mit Aufgaben und Kontrollfragen. Berlin Heidelberg: Springer-Verlag.

Schallmo, D., and L. Brecht. 2010. Business Model Innovation in Business-to-Business Markets - Procedure and Examples. In: Proceedings of the 3rd ISPIM Innovation. Symposium: “Managing the Art of Innovation: Turning Concepts into Reality,” 1–24.

Schaltegger, S., F.L. Freund, and E.G. Hansen. 2012. Business cases for sustainability: the role of business model innovation for corporate sustainability. International Journal of Innovation and Sustainable Development 6 (2), 95–119.

Schawbel, D. 2012. How Robin Chase Reinvented the Transportation Industry. Forbes. https://www.forbes.com/sites/danschawbel/2012/06/22/how-robin-chase-reinvented-the-transportation-industry/#388849e0346d.

Schnell, R., P. Hill, and E. Esser. 1989. Methoden der empirischen Sozialforschung. 2nd ed. München [a.o.]: Oldenbourg.

Schögel, M., and M. Knaak. 2017. Digitalizing the Customer Process ? Opportunities and Risks for Financial Services. In: Dienstleistungen 4.0, edited by, Manfred Bruhn and Karsten Hadwich, 455–482. Wiesbaden: Springer Fachmedien Wiesbaden.

Schwaninger, M. 2009. System Dynamics in the Evolution of the Systems Approach. In: Encyclopedia of Complexity and Systems Science, edited by, Robert A. Meyers, 8974–8987. New York: Springer New York.

Schweizer, L. 2005. Concept and evolution of business models. Journal of General Management 31 (2), 37–56.

Shafer, S.M., H.J. Smith, and J.C. Linder. 2005. The power of business models. Business Horizons 48 (3), 199–207.

Shah, D., R.T. Rust, A. Parasuraman, R. Staelin, and G.S. Day. 2006. The path to customer centricity. Journal of Service Research 9 (2), 113–124.

Shaheen, S., and A. Cohen. 2019. Shared ride services in North America: definitions, impacts, and the future of pooling. Transport Reviews 39 (4), 427–442.

Shaheen, S., A. Cohen, and I. Zohdy. 2016. Shared Mobility: Current Practices and Guiding Principles. U.S. Department of Transportation. Federal Highway Administration.

Shahraki, A., and O. Haugen. 2018. Social ethics in Internet of Things: An outline and review. In: 2018 IEEE Industrial Cyber-Physical Systems (ICPS), 509–516. IEEE.

Shahrivari, S. 2014. Beyond Batch Processing: Towards Real-Time and Streaming Big Data. Computers 3 (4), 117–129.

Shepherd, C., and P.K. Ahmed. 2000. From product innovation to solutions innovation: a new paradigm for competitive advantage. European Journal of Innovation Management 3 (2), 100–106.

Sheridan, S., and N. Bullinger. 2001. Building a solutions-based organization. Journal of Business Strategy 22 (1), 36–40.

Sheth, J., R. Sisodia, and A. Sharma. 2000. The Antecedents and Consequences of Customer-Centric Marketing. Journal of the Academy of Marketing Science 28 (1), 55–66.

Šimůnková, K. 2019. Being hybrid: a conceptual update of consumer self and consumption due to online/offline hybridity. Journal of Marketing Management 35 (1–2), 40–74.

Skarp, F., and L.-E. Gadde. 2008. Problem solving in the upgrading of product offerings — A case study from the steel industry. Industrial Marketing Management 37 (6), 725–737.

Slywotzky, A.J. 1996. Value Migration: How to think several moves ahead of the competition. Boston, Mass.: Harvard Business School Press.

Sosna, M., R.N. Trevinyo-Rodríguez, and S.R. Velamuri. 2010. Business model innovation through trial-and-error learning: The naturhouse case. Long Range Planning 43 (2–3), 383–407.

Stabell, C.B., and O.D. Fjeldstad. 1998. Configuring value for competitive advantage: On chains, shops ,and networks. Strategic Management Journal 19, 413–437.

Stampfl, G. 2016. The Process of Business Model Innovation. An Empirical Exploration. Wiesbaden: Springer Fachmedien Wiesbaden.

Stauss, B., and M. Bruhn. 2009. Serviceorientierung im Unternehmen - Eine Einführung in die theoretischen und praktischen Problemstellungen. In: Kundenintegration, edited by, Manfred Bruhn and Bernd Stauss, 3–33. Wiesbaden: Gabler.

Sterman, J. 2000. Business dynamics : systems thinking and modeling for a complex world. Boston: McGraw-Hill.

Stokes, D.E. 1997. Pasteur’s quadrant : basic science and technological innovation. Washington, DC: Brookings Institution Press.

Storbacka, K. 2011. A solution business model: Capabilities and management practices for integrated solutions. Industrial Marketing Management 40 (5), 699–711.

Storbacka, K., P. Frow, S. Nenonen, and A. Payne. 2012. Designing Business Models for Value Co-Creation. Special Issue – Toward a Better Understanding of the Role of Value in Markets and Marketing, 51–78.

Storbacka, K., C. Windahl, S. Nenonen, and A. Salonen. 2013. Solution business models: Transformation along four continua. Industrial Marketing Management 42 (5), 705–716.

Stremersch, S., S. Wuyts, and R.T. Frambach. 2001. The Purchasing of Full-Service Contracts : An Exploratory Study within the Industrial Maintenance Market. Industrial Marketing Management 12 (1), 1–12.

Sydow, J. 1992. Strategische Netzwerke: Evolution und Organisation. Wiesbaden: Gabler.

Sydow, J. 2003. Typen und Typologien sozialer Netzwerke. In: Kompetenzentwicklung in Netzwerken: eine typologische Studie, edited by, Jörg Sydow, S. Duschek, G. Möllering, and M. Rometsch, 48–71. Wiesbaden: Westdeutscher Verlag.

Sydow, J. 2010a. Management von Netzwerkorganisationen – Zum Stand der Forschung. In: Management von Netzwerkorganisationen, edited by, Jörg Sydow, 373–470. Wiesbaden: GWV Fachverlage GmbH.

Sydow, J. 2010b. Editorial – Über Netzwerke, Allianzsysteme, Verbünde, Kooperationen und Konstellationen. In: Management von Netzwerkorganisationen, edited by, Jörg Sydow, 1–7. Wiesbaden: GWV Fachverlage GmbH.

Tan, A.R. 2010. Service-oriented product development strategies. Product/Service-Systems (PSS) development. Kgs. Lyngby: DTU Management.

Tan, K.H., G. Ji, C.P. Lim, and M.-L. Tseng. 2017. Using big data to make better decisions in the digital economy. International Journal of Production Research 55 (17), 4998–5000.

Teece, D.J. 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strategic Management Journal 28 (13), 1319–1350.

Teece, D.J. 2010. Business Models, Business Strategy and Innovation. Long Range Planning 43, 172–194.

Teece, D.J. 2018. Business models and dynamic capabilities. Long Range Planning 51 (1), 40–49.

Teece, D.J., G. Pisano, and A. Shuen. 1997. Dynamic capabilities and strategic management. Strategic Management Journal 18 (7), 509–533.

Terzi, D.S., R. Terzi, and S. Sagiroglu. 2015. A survey on security and privacy issues in big data. In: 2015 10th International Conference for Internet Technology and Secured Transactions (ICITST), 202–207. IEEE.

Thesmann, S. 2016. Interface Design: Usability, User Experience und Accessibility im Web gestalten. Wiesbaden: Springer Vieweg.

Thoben, K., J. Eschenbächer, and H. Jagdev. 2001. Extended Products : Evolving Traditional Product Concepts. In: 7th International Conference on Concurrent Enterprising, 429–439. Bremen.

Timmers, P. 1998. Business Models for Electronic Markets. In: CommerceNet. Research Note #98-21.

Töpfer, A. 2012. Erfolgreich Forschen. 3rd ed. Springer-Lehrbuch. Berlin, Heidelberg: Springer Berlin Heidelberg.

Tschiesner, A., T. Möller, M. Kässer, S. Patrick, and F. Kley. 2019. Mastering new mobility. Perspectives on navigating an uncertain future. McKinsey Center for Future Mobility. https://www.mckinsey.com/~/media/McKinsey/Industries/Automotive and Assembly/Our Insights/How automakers can master new mobility/Mastering-new-mobility-Perspectives-on-navigating-an-uncertain-future.ashx.

Tukker, A. 2004. Eight types of product-service system: eight ways of sustainability? Experiences from Suspronet. Business Strategy and the Environment 13, 246–260.

Tuli, K., A. Kohli, and S. Bharadwaj. 2007. Rethinking Customer Solutions : From Product Bundles to Relational Processes. Journal of Marketing 71 (3), 1–17.

UNCTAD. 2019. Trends in global export volume of trade in goods from 1950 to 2018 (in billion U.S. dollars). Ed. Statista. https://www.statista.com/statistics/264682/worldwide-export-volume-in-the-trade-since-1950/.

Vandermerwe, S., and J. Rada. 1988. Servitization of business: Adding value by adding services. European Management Journal 6 (4), 314–324.

Vanhaverbeke, W., and M. Cloodt. 2006. Open innovation in value networks. In: Open innovation: Researching a New Paradigm, edited by, Henry Chesbrough, Wim Vanhaverbeke, and Joel West, 258–281. Oxford: Oxford University Press.

Vargo, S.L., and R.F. Lusch. 2004. Evolving to a New Dominant Logic for Marketing. Journal of Marketing 68 (1), 1–17.

Vargo, S.L., and R.F. Lusch. 2006. Service-dominant logic: reactions, reflections and refinements. Marketing Theory 6 (3), 281–288.

Vargo, S.L., and R.F. Lusch. 2008. From goods to service(s): Divergences and convergences of logics. Industrial Marketing Management 37 (3), 254–259.

Vargo, S.L., and R.F. Lusch. 2011. It's all B2B...and beyond: Toward a systems perspective of the market. Industrial Marketing Management 40 (2), 181–187.

Vargo, S.L., P.P. Maglio, and M.A. Akaka. 2008. On value and value co-creation: A service systems and service logic perspective. European Management Journal 26 (3), 145–152.

Vasilakos, A., and W. Pedrycz. 2006. Ambient Intelligence : Visions and Technologies. In: Ambient Intelligence, Wireless Networking, and Ubiquitous Computing, edited by, Athanasios Vasilakos and Witold Pedrycz, 1–12. Norwood: Artech House Inc.

Voelpel, S.C., M. Leibold, and E.B. Tekie. 2004. The wheel of business model reinvention: how to reshape your business model to leapfrog competitors. Journal of Change Management 4 (3), 259–276.

Wagner, I. 2019. Mobility services. A Statista DossierPlus on mobility services for passengers. Ed. Statista. https://www.statista.com/study/67454/mobility-services/.

We are Social, and StatCounter. 2018. Percentage of all global web pages served to mobile phones from 2009 to 2018. Ed. Statista. https://www.statista.com/statistics/241462/global-mobile-phone-website-traffic-share/.

Weiber, R., and R. Hörstrup. 2009. Von der Kundenintegration zur Anbieterintegration : Die Erweiterung anbieterseitiger Wertschöpfungsprozesse auf kundenseitige Nutzungsprozesse. In: Kundenintegration, edited by, Manfred Bruhn and Bernd Stauss, 281–312. Wiesbaden: Gabler.

Weiber, R., R. Hörstrup, and D. Mühlhaus. 2011. Akzeptanz anbieterseitiger Integration in die Alltagsprozesse der Konsumenten: Erste empirische Ergebnisse. Zeitschrift für Betriebswirtschaft 81 (5), 111–145.

Wernerfelt, B. 1989. From critical resources to corporate strategy. Journal of General Management 14, 4–12.

Wernerfelt, B. 1995. The Resource-Based View of the Firm - Ten Years After. Strategic Management Journal 16 (3), 171–174.

White, S.A. 2006. Introduction to BPMN. IBM Corporation.

White, S.A., and C. Bock. 2012. New Capabilities for Process Modeling in BPMN 2.0. In: BPMN 2.0 Handbook. Second Edition: Updated and Expanded. Methods, Concepts, Case Studies and Standards in Business Process Modeling Notation (BPMN), edited by, Layna Fischer, 17–30. 2nd ed. Lighthouse Point: Future Strategies Inc.

White, S.A., and D. Miers. 2008. BPMN Modeling and Reference Guide: Understanding and Using BPMN. Lighthouse Point: Future Strategies Inc.

Whitmore, A., A. Agarwal, and L. Da Xu. 2015. The Internet of Things - A survey of topics and trends. Information Systems Frontiers 17 (2), 261–274.

Wiener, N. 1948. Cybernetics or control and communication in the animal and the machine. Paris: Hermann [a.o.].

Wiesner, S., I. Westphal, M. Hirsch, and K.-D. Thoben. 2013. Manufacturing Service Ecosystems. In: Advances in Production Management Systems. Competitive Manufacturing for Innovative Products and Services: IFIP WG 5.7 International Conference, APMS 2012, Rhodes, Greece, September 24-26, 2012, Revised Selected Papers, Part II, edited by, Christos Emmanouilidis, Marco Taisch, and Dimitris Kiritsis, 305–312. Berlin, Heidelberg: Springer Berlin Heidelberg.

Williamson, O.E. 1991. Comparative Economic Organization : The Analysis of Discrete Structural Alternatives. Administrative Science Quarterly 36 (2), 269–296.

Windahl, C. 2015. Understanding solutions as technology-driven business innovations. Journal of Business & Industrial Marketing 30 (3/4), 378–393.

Windahl, C., P. Andersson, C. Berggren, and C. Nehler. 2004. Manufacturing firms and integrated solutions: characteristics and implications. European Journal of Innovation Management 7, 218–228.

Windahl, C., and N. Lakemond. 2006. Developing integrated solutions : The importance of relationships within the network. Industrial Marketing Management 35, 806–818.

WIPO. 2019. Number of patent applications worldwide from 1990 to 2018. Ed. Statista. https://www.statista.com/statistics/257610/number-of-patent-applications-worldwide/.

Wirtz, B.W. 2000. Electronic Business. Wiesbaden: Gabler.

Wirtz, B.W. 2013. Business Model Management: Design - Instrumente - Erfolgsfaktoren von Geschäftsmodellen. 3rd ed. Wiesbaden: Springer Gabler.

Wirtz, B.W. 2016. E-Book: Business Model Management. Design Process Instruments. 2nd ed. Speyer.

Wirtz, B.W. 2018. Business Model Management. Design - Instrumente - Erfolgsfaktoren von Geschäftsmodellen. 4th ed. Wiesbaden: Springer Gabler.

Wirtz, B.W., A. Pistoia, S. Ullrich, and V. Göttel. 2016. Business Models: Origin, Development and Future Research Perspectives. Long Range Planning 49, 36–54.

Wise, R., and P. Baumgartner. 1999. Go Downstream. The New Profit Imperative in Manufacturing. Harvard Business Review (September-October), 133–142.

Woerner, S.L., and B.H. Wixom. 2015. Big Data: Extending the Business Strategy Toolbox. Journal of Information Technology 30, 60–62.

Yaqoob, I., I.A.T. Hashem, A. Gani, S. Mokhtar, E. Ahmed, N.B. Anuar, and A. V. Vasilakos. 2016. Big data: From beginning to future. International Journal of Information Management 36 (6), 1231–1247.

Yin, R.K. 2003. Case study research: Design and Methods. 3rd ed. Thousand Oaks: Sage.

Zafer, A.S. 2015. Authentic Customer Centricity : A Journey Towards Sustainable Customer Experience. Charlotte, NC: Information Age Publishing.

Zenger, T.R., and W.S. Hesterly. 1997. The Disaggregation of Corporations: Selective Intervention, High-powered Incentives, and Molecular Units. Organization Science 8 (3), 209–222.

Zheng, Z. (Eric). 2015. Introduction to Big Data Analytics and the Special Issue on Big Data Methods and Applications. Journal of Management Analytics 2 (4), 281–284.

Zinkann, R., and J. Mahadevan. 2018. Zukünftige Customer Journeys und deren Implikationen für die Unternehmenspraxis. In: Marketing Weiterdenken. Zukunftspfade für eine marktorientierte Unternehmensführung, edited by, Manfred Bruhn and Manfred Kirchgeorg, 157–170. Wiesbaden: Springer Fachmedien Wiesbaden.

Zollenkop, M. 2006. Geschäftsmodellinnovation: Initiierung eines systematischen Innovationsmanagements fur Geschäftsmodelle auf Basis lebenszyklusorientierter Frühaufklärung. Wiesbaden: Deutscher Universitäts-Verlag, GWV Fachverlage GmbH, Wiesbaden.

Zott, C., and R. Amit. 2008. The fit between product market strategy and business model: implications for firm performance. Strategic Management Journal 29, 1–26.

Zott, C., and R. Amit. 2009. The Business Model as the Engine of Network-Based Strategies. In: The network challenge, edited by, Paul Kleindorfer, Yoram J. Wind, and Robert E. Gunther, 259–276. New Jersey: Wharton School Publishing.

Zott, C., and R. Amit. 2010. Business Model Design: An Activity System Perspective. Long Range Planning 43 (2–3), 216–226.

Zott, C., R. Amit, and L. Massa. 2011. The Business Model: Recent Developments and Future Research. Journal of Management 37 (4), 1019–1042.

zu Knyphausen-Aufseß, D., and Y. Meinhardt. 2002. Revisiting Strategy : Ein Ansatz zur Systematisierung von Geschäftsmodellen. In: Zukünftige Geschäftsmodelle. Konzept und Anwendung in der Netzökonomie, edited by, Thomas Bieger, Nils Bickhoff, R. Caspers, Dodo zu Knyphausen-Aufseß, and K. Reding, 63–89. Berlin, Heidelberg: Springer-Verlag.